Petrified Forest National Park • Arizona

National Park Service • U.S. Department of the Interior

General Management Plan Amendment /Environmental Assessment

GENERAL MANAGEMENT PLAN AMENDMENT ENVIRONMENTAL ASSESSMENT

Petrified Forest National Park

Apache and Navajo Counties, Arizona

Petrified Forest National Park is in northeastern Arizona, about 100 miles east of Flagstaff, Arizona. Until 2004, Petrified Forest was 93,533 acres in size, with about half of that acreage being designated wilderness. In December 2004 Congress passed and the president signed the Petrified Forest National Park Expansion Act (Public Law 108-430), which expanded the authorized park boundary by approximately 125,000 acres to include adjacent lands having globally significant paleontological resources and nationally significant archeological resources. Of the 125,000 acres added to the park, approximately 59% is in private ownership. The state of Arizona owns about 29%, and those lands will be transferred to the National Park Service or managed under an agreement with the state if an acquisition plan cannot be negotiated. The remaining 12% of the addition lands was transferred from the Bureau of Land Management to the National Park Service in May 2007.

The Petrified Forest National Park Expansion Act directs the National Park Service to amend the park's 1993 *General Management Plan* to describe how the addition lands would be managed once they are acquired. The purpose of this amendment is to establish the overall management direction (for the next 15 to 20 years) for these addition lands, including protection of natural and cultural resources, visitor use and access, infrastructure that may be needed, education and interpretive efforts, etc.

This document describes two alternatives for managing the Petrified Forest National Park addition lands for the next 15 to 20 years, and the impacts on the environment of implementing each alternative. The no-action alternative describes continuation of existing management and serves as a basis of comparison for the action alternative.

The action alternative describes what park management would be like once private parcels in the addition lands are acquired from willing sellers and the Park Service has acquired the state lands (or developed a cooperative management agreement for state land). Until such time as private lands can be acquired by the National Park Service from willing sellers, the Park Service would consider additional strategies (e.g., conservation easements, public recreational access easements, partnerships, and/or other cooperative efforts — all with willing private landowners) for conserving high-priority parcels and for providing appropriate public access. The action alternative has been identified as the NPS preferred management approach.

Under the action alternative, the National Park Service would manage the addition lands cautiously while gathering as much information about them as possible during the next 15 to 20 years. Initial priorities would be to conduct resource inventories, condition assessments, and research to increase NPS and public understanding of these lands. Eventually, opportunities for visitors to experience the addition lands would become available; these opportunities would be made available when there is minimal risk of resource damage or rendering lands ineligible for wilderness consideration. Sensitive resources would be preserved and/or rehabilitated as appropriate, with particular emphasis on paleontological and archeological resources (the addition lands were added to the park primarily for their paleontological and archeological significance). Actions would avoid degrading wilderness characteristics, pending completion of a future required wilderness study for the addition lands.

Once the National Park Service has assumed management responsibility for most of the addition lands (from willing sellers) and has completed key baseline inventories and condition assessments, the National Park Service would complete a comprehensive general management plan for the entire park and a wilderness study for the addition lands.

The key impacts of implementing the alternatives are described in "Chapter 4: Environmental Consequences" and summarized in table 4.

This document has been distributed to other agencies and interested organizations and individuals for their review and comment. The public comment period for this document will last for 30 days after this document is published and distributed. Please note that NPS practice is to make comments, including names and addresses of respondents, available for public review. Please see "How to Comment on this Plan" discussion on the next page for further information.

HOW TO COMMENT ON THIS PLAN

Comments on this plan are welcome and will be accepted for 30 days after this document is published and distributed. Comments/ responses may be submitted either over the Internet or in writing. Commenters are encouraged to use the Internet if at all possible. Please submit only one set of comments.

To be sure that you are included on our mailing list, please include your name and address on any correspondence.

Internet comments can be submitted at <http://www.nps.gov/pefo> and then choose the park planning link.

Written comments may be sent to

Superintendent
Petrified Forest National Park
P.O. Box 2217
Petrified Forest, AZ 86028

Verbal comments may be made at public meetings. The dates, times, and locations of public meetings will be announced in the media following release of this document.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment — including your personal identifying information — may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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A GUIDE TO THIS DOCUMENT

This *General Management Plan Amendment* is organized into five chapters plus appendixes. Each section is described briefly below.

Chapter 1: Introduction describes the context for the entire document. It explains why the plan is being prepared and what issues it will address. It provides guidance (e.g., park purpose, significance, fundamental resources and values, special mandates servicewide laws and policies) for the alternatives that are being considered. This chapter also describes how this plan relates to other plans and projects.

Chapter 2: Alternatives, discusses two alternatives and user capacity. Mitigative measures for minimizing or eliminating impacts of some proposed actions are then described. Sections on the environmentally preferred alternative and alternatives considered but dismissed follow. A summary comparison table of the alternatives (table 2) is followed by a summary comparison table of the environmental consequences (table 3) of implementing the alternatives.

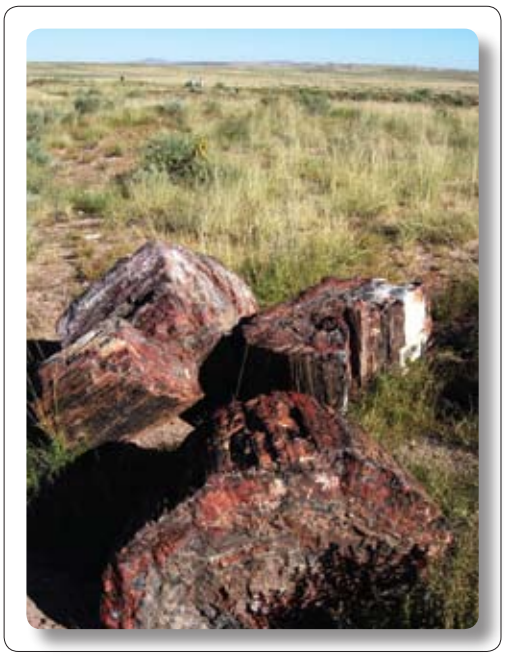
Chapter 3: Affected Environment describes areas and resources that would be affected by actions in the two alternatives — natural resources, cultural resources, visitor use and experience, park operations, and the socioeconomic environment. It also includes a discussion of impact topics that were dismissed from detailed analysis.

Chapter 4: Environmental Consequences analyzes the impacts of implementing the alternatives. Methods used to assess impacts are outlined at the beginning of each topic.

Chapter 5: Consultation and Coordination describes the history of public and agency coordination during the planning effort; it also lists agencies and organizations who received copies of the document.

The **Appendixes** present supporting information for the document, along with bibliographic references and a list of the planning team and consultants.

Introduction 1



OVERVIEW OF THE PARK ADDITION LANDS

Petrified Forest National Park is in northeastern Arizona, about 100 miles east of Flagstaff, Arizona (see Vicinity map). The park is bounded by the Navajo Indian Reservation to the north, and by private lands, state lands, and U.S. Bureau of Land Management (BLM) lands to the south, east, and west. At the time the park was established, it was 93,533 acres in size, with about half of that acreage being designated wilderness arranged in two separate units — the Painted Desert unit in the northern section of the park and the Rainbow Forest unit in the southeast section of the park.

The park's 1993 *General Management Plan* recommended that the park be expanded by approximately 97,800 acres to include adjacent lands having globally significant paleontological resources and nationally significant archeological resources. The plan stated that if the park boundary was expanded by Congress, a land protection plan would need to be prepared to determine how to most appropriately manage the lands and resources.

In December 2004 the Petrified Forest National Park Expansion Act (Public Law 108-430; see appendix A) was passed, which expanded the authorized park boundary by approximately 125,000 acres (see Surface Ownership map). As stated in Congressional Report 108-713, the 2004 acreage differs somewhat from the area recommended for expansion in 1993 to reflect the need to avoid leaving private landowners with uneconomical property remnants and the additional knowledge gained about the relevant (addition) lands since the 1993 plan was finalized (see Comparison of Proposed versus Actual Addition Lands map, which compares the two areas).

The addition lands (the 125,000 acres) include 16 miles of the 22-mile Chinle escarpment, an east-west trending series of bluffs and badlands that contains one of the world's most significant records of Late Triassic period fossils. Previously, only the central 6 miles of this resource-rich escarpment fell within the park boundary; the east and west portions of this escarpment are believed to contain significant scientific resources that surpass those already in the park. Other important additions in the expansion area are the Wallace Tank Ruins, Rainbow Forest Badlands, and Canyon Butte Ruins around the southern end of the park; the west rim of the Painted Desert to the northwest; the Dead Wash petroglyphs to the east; and about 25 miles of the Puerco River riparian area.

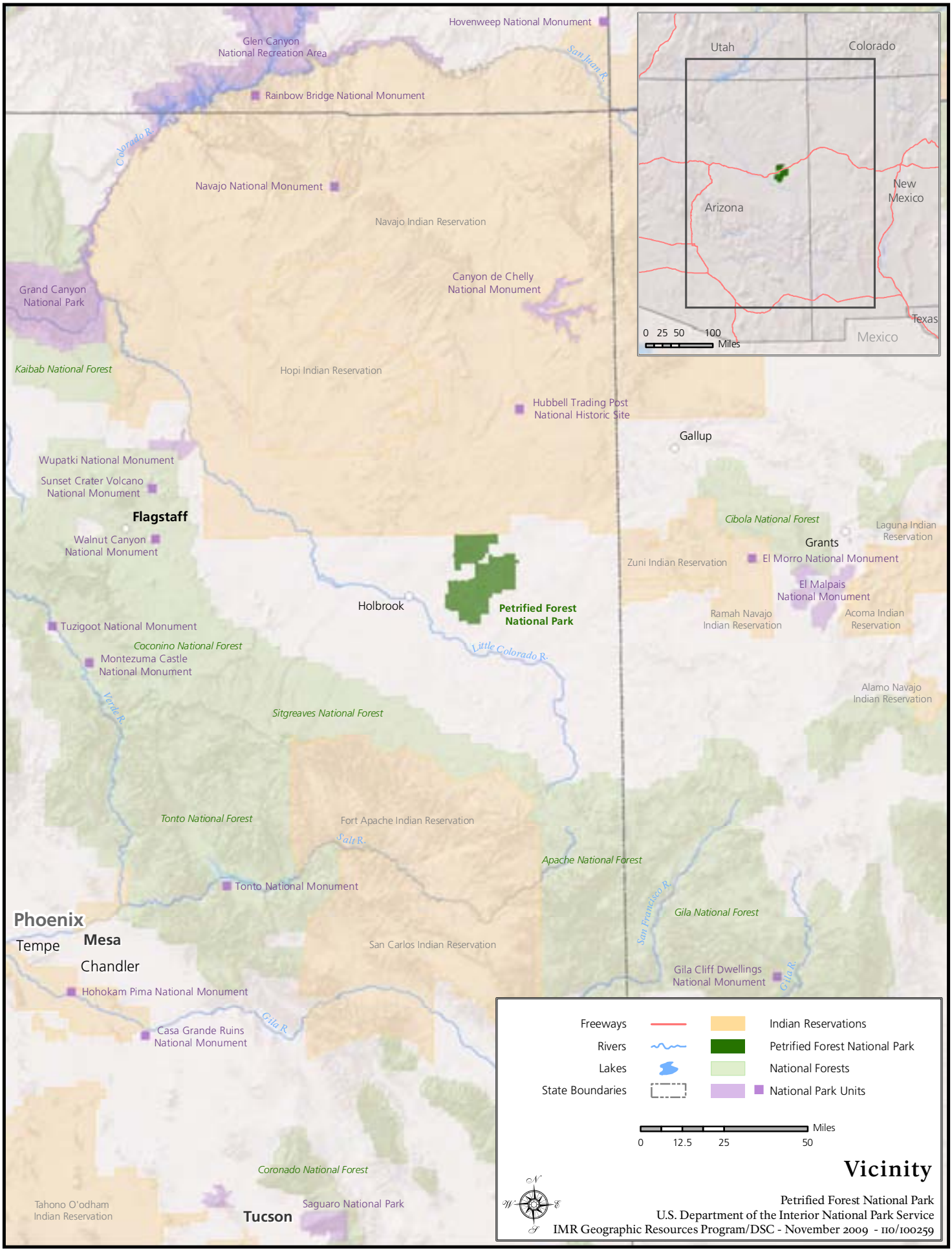
Of the 125,000 acres added to the park, approximately 59% is in private ownership, pending potential future acquisition by the National Park Service from willing sellers. Twenty-nine percent is owned by the state of Arizona and will be transferred to the National Park Service or managed under an agreement with the state if an acquisition plan cannot be negotiated. (It may be many years before the expansion area — hereafter referred to as "addition lands" — becomes part of the national park in the traditional sense, because the National Park Service does not control private or state lands.) The remaining 12% of the addition lands was transferred from the Bureau of Land Management (BLM) to the National Park Service in May 2007. As shown on the Surface Ownership map, the majority of these federal, state, and private lands occur in a checkerboard ownership pattern. This pattern is common throughout this portion of Arizona and extends beyond the boundary of the park.

Table 1 provides a summary of surface ownership for the addition lands. See the section of this chapter titled, "Special Mandates, Agreements, and Administrative Commitments" for information on how private and state lands may be acquired by the National Park Service.

TABLE 1. SURFACE OWNERSHIP WITHIN THE ADDITION LANDS

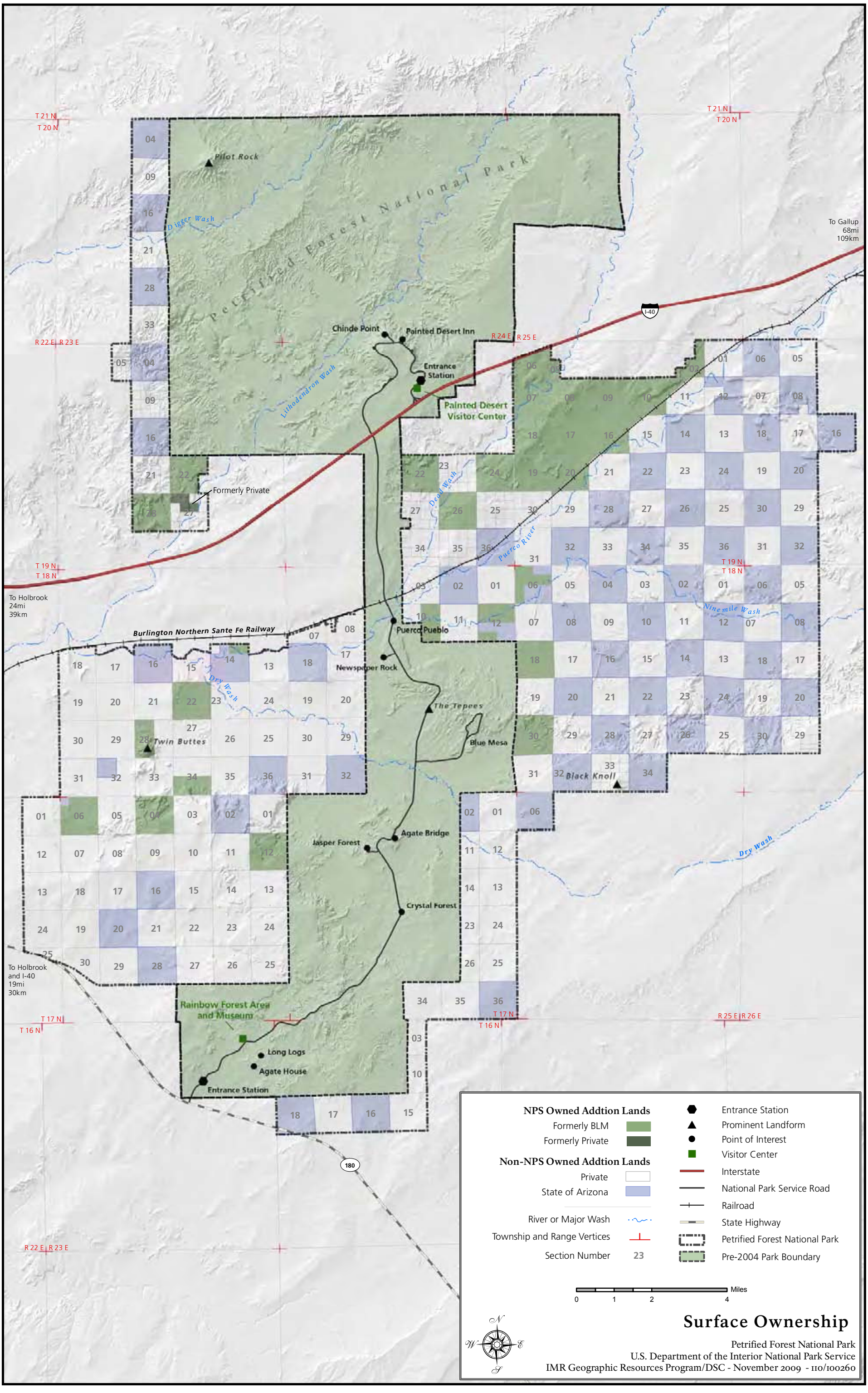
Landownership Type	Acres	Percentage
National Park Service (formerly BLM)	15,200	12%
State of Arizona	35,900	29%
Private	73,900	59%
Total	**125,000**	**100%**

Note: Acreage calculations are as of 2009 and were estimated using a combination of legal descriptions and GIS (geographic information systems) analysis.



Vicinity

Petrified Forest National Park
U.S. Department of the Interior National Park Service
IMR Geographic Resources Program/DSC - November 2009 - 110/100259



Surface Ownership

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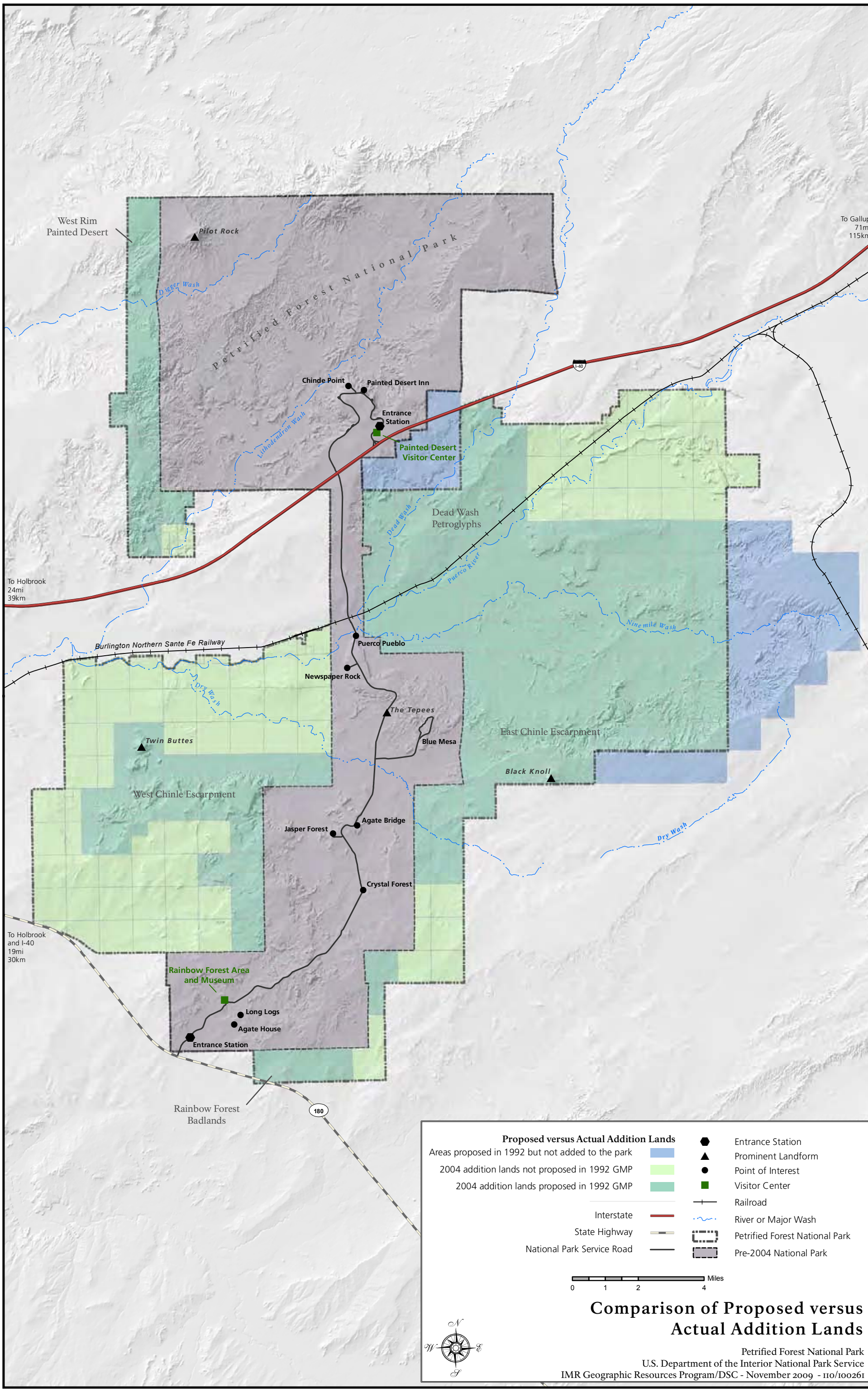


Comparison of Proposed versus Actual Addition Lands

Petrified Forest National Park
U.S. Department of the Interior National Park Service
IMR Geographic Resources Program/DSC - November 2009 - 110/100261

BACKGROUND FOR THE PLANNING EFFORT

PURPOSE OF THE PLAN AMENDMENT

The Petrified Forest National Park Expansion Act directs the National Park Service to amend the park's 1993 *General Management Plan* (GMP) to describe how the addition lands will be managed once acquired. The purpose of this amendment is to establish the overall management direction (for the next 15 to 20 years) for these new addition lands, including protection of natural and cultural resources, visitor use and access, infrastructure that may be needed, education and interpretive efforts, and external pressures on these lands.

Once the National Park Service has assumed management responsibility for most of the addition lands and completed key baseline inventories and condition assessments, it would complete a comprehensive general management plan for the entire park and a wilderness study for the addition lands.

NEED FOR THE PLAN AMENDMENT

The plan amendment is needed to provide management direction for the addition lands until a more comprehensive general management plan and wilderness study can integrate management of the addition lands with the rest of the park. The park's 1993 *General Management Plan* and 2004 *General Management Plan Revision* did not address management of the addition lands because these lands had not yet been added to the legislated park boundary.

As directed in the expansion act, a GMP amendment is needed to

- define how the addition lands would be managed once acquired by the National Park Service;
- define and apply management zones that prescribe how the addition lands would be managed with regard to natural and cultural resources and visitor opportunities; and
- serve as the basis for later, more detailed management documents such as five-year strategic plans and implementation plans for the addition lands.

This GMP amendment does not describe how particular programs or projects should be prioritized or implemented. Those decisions will be addressed later in more detailed strategic and implementation plans that follow the approved GMP amendment.

COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

This study is compliant with the National Environmental Policy Act (NEPA), which mandates all federal agencies to analyze the impacts of major federal actions that may have a significant effect on the environment. The National Park Service's guidance outlines several options for meeting the requirements of the act, depending on the severity of the environmental impacts of the alternatives.

An environmental assessment was determined to be the most appropriate instrument for this plan, based on a number of considerations. There is no apparent controversy surrounding this planning effort, and the agency's preferred alternative was not expected to have major (significant) effects on the environment or cause impairment of park resources and values. Most adverse impacts of the NPS preferred alternative were anticipated to be negligible to minor in intensity.

NEXT STEPS

After the distribution of the *General Management Plan / Environmental Assessment*, there will be a 30-day public review and comment period, after which the NPS planning team will evaluate comments from other federal, state, and local agencies; organizations; businesses; and individuals regarding the plan. Appropriate changes will be incorporated into a "Finding of No Significant Impact" (FONSI), which documents the NPS selection of an alternative for implementation. Also, the Finding of No Significant Impact" will include any necessary errata sheet(s) for factual changes required in the document, as well as responses to substantive comments by agencies, organizations, or the general public. Once the Finding of No Significant Impact" is signed by the NPS regional director, and following a 30-day waiting period, the plan can then be implemented.

IMPLEMENTATION OF THE PLAN

The approval of this plan does not guarantee that the funding and staffing needed to implement the plan will be forthcoming. The implementation of the approved plan will depend on future funding, and it could also be affected by factors such as changes in NPS staffing, visitor use patterns, and unanticipated environmental changes. Full implementation could be many years in the future. Once the plan has been approved, additional feasibility studies and more detailed planning, environmental documentation, and consultations would be completed, as appropriate, before certain actions in the selected alternative can be carried out.

Future program and implementation plans, describing specific actions that managers intend to undertake and accomplish in the park, will tier from the desired conditions and long-term goals set forth in the approved general management plan.

FOUNDATION FOR PLANNING AND MANAGEMENT

This foundation for planning and management provides essential guidance for park-wide planning decisions, which includes the addition lands. The park's foundation statement was revised by the National Park Service in July 2006, after Congress authorized the park expansion. It includes a description of the park addition lands' significance and fundamental resources and values, based on supporting information contained in the 1993 *General Management Plan* about the proposed boundary adjustment. The foundation statement may need to be updated after inventories are completed and the resources of the addition lands are better understood.

The foundation includes the following for Petrified Forest National Park: (1) the purpose statement; (2) the significance statements; (3) fundamental and other important resources and values; (4) interpretive themes; (5) special mandates, agreements, and administrative constraints; and (6) servicewide laws and policies. These elements are defined below. Following the definitions, the planning foundation is presented.

The park ***purpose*** is the specific reason for establishing a particular park. Statements of the park's purpose are grounded in a thorough analysis of the park's legislation (or executive order) and legislative history, including studies done before authorization to document shared assumptions about what the law means in terms specific to the park.

Park ***significance statements*** express why the park's resources and values are important enough to warrant national park designation. Statements of the park's significance describe why an area is important within a global, national, regional, and systemwide context; significance statements are directly linked to the purpose of the park. These statements are substantiated by data or consensus and reflect the most current scientific or scholarly inquiry and perceptions, which may have changed since the park's establishment.

Park ***fundamental resources and values*** are those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to warrant primary consideration during planning and management because they are critical to achieving the park's purpose and maintaining its significance. A fundamental value, unlike a tangible resource, refers to a process, force, story, or experience, such as an island experience, the ancestral homeland, wilderness values, key viewsheds adjacent to a park boundary, relationships among people, or oral histories. "Other important resources and values" may warrant special consideration during general management planning, but they do not contribute directly to the purpose and significance of the park.

Primary interpretive themes are the most important ideas or concepts to be communicated to the public about a park. They support the desired interpretive outcome of increasing visitor understanding and appreciation of the significance of the park's resources. Primary interpretive themes are based on the park's purpose and significance.

Special mandates are legal requirements and administrative commitments that apply to a specific unit of the national park system and provide sideboards to planning and management. They are mandated by Congress or by signed agreements with other entities. They are specific to the park, but they are not an inventory of all the laws applicable to the national park system. Agreements between the park and other entities, as well as important administrative constraints, are also included in this section.

Servicewide laws and policies govern all units of the national park system.

Purpose

The purpose of Petrified Forest National Park is to preserve, protect, and provide opportunities to experience globally significant Late Triassic paleontological resources, nationally significant archeological sites, and scenic and natural resources, including the Painted Desert, and to foster scientific research and public understanding and appreciation of park resources.

Significance Statements and Associated Fundamental Resources and Values

Significance Statement: The Late Triassic fossil floras and faunas preserved at Petrified Forest National Park are globally significant because they provide a distinct record of diverse terrestrial ecosystems that occurred between about 205 and 220 million years ago. The park has one of the largest and most colorful deposits of mineralized wood in the world. These extensive and remarkable paleontological resources illustrate variability, regional changes in plants and animals, including early dinosaurs, through place and time; lead to discoveries of important new species; and provide other insights that influence the world's research and knowledge of Late Triassic terrestrial biotas.

Fundamental resources and values:

- Late Triassic period terrestrial plant and animal fossils in the Chinle Formation
- petrified wood deposits in a natural setting
- fossils, including petrified wood, that will continue to be preserved for scientific study (the museum collection), including more than 85 holotypes (as of 2008) of extinct plants and animals (a holotype is the specimen used to describe a particular species)

Significance Statement: Petrified Forest National Park contains some of the best exposures of Late Triassic terrestrial rocks and strata in the world. The Chinle Formation in the park preserves a variety of strata that represent ancient sedimentary environments (rivers, floodplains, lakes, swamps, soils, etc.) and their relationships to each other. The current landscape formed by geologic processes that are integral to the paleontological

resources, prehistoric and historic travel corridors, the movement and distribution of modern flora and fauna, and scenic sculpted badlands, including the Painted Desert.

Fundamental resources and values:

- preserved depositional environments
- erosional properties
- extensive (miles long) exposures of this formation
- erosional processes and resulting features, such as buttes, mesas, and hoodoos
- significant deposits of Late Triassic terrestrial plant and animal fossils

Significance Statement: Petrified Forest contains the largest example of recovering native grassland in the southern Colorado Plateau region. This semi-desert short-grass prairie and semi-desert shrub steppe preserve habitats for a variety of flora and fauna and provide refuge for several animals of concern, such as pronghorn and prairie dogs.

Fundamental resources and values:

- a diversity of flora and fauna, including shared characteristics of three ecological regions (Great Basin, Sonoran, and Great Plains)
- ecological values — structure and composition, function, health, and recovery —because of the lack of recent grazing relative to other areas of short-grass prairie
- ephemeral water resources (washes, seeps and springs, stock tanks, tinajas, depressions), which are critically important for flora and fauna
- riparian areas, which are critically important for refuge and habitat
- some of the cleanest air in the country

Significance Statement: Petrified Forest National Park contains a complex array of archeological resources, including petroglyphs that illustrate a 12,000-year continuum of human land use. Subtle but challenging landforms influenced human movements on both north-south and east-west routes from prehistoric times to the present. These landforms affected and affect regional patterns of settlement, trade, and migration. Shifting cultural boundaries in this area created a high diversity of cultural sites and features that are still important to modern American Indians of the region.

Fundamental resources and values:

- evidence of ongoing use and occupation spans Paleo-Indian culture to modern American Indian culture — Resources include hunter/gatherer sites and early large pithouse villages with an outstanding collection of the earliest pottery in the region. Evidence also illustrates the interaction between people and their environment — for example cultural landscapes, use and trade of petrified wood as lithic material, and human relationships to ephemeral sources of water. Examples of archeological resources that are on the National Register of Historic Places include Agate House Pueblo, Puerco Ruins and petroglyphs, the Flattops site, the Twin Buttes Archeological District, and the Painted Desert petroglyphs.
- thousands of documented petroglyphs and dozens of pictographs of high integrity — Many petroglyphs are related to sociopolitical boundaries of the overlapping cultures and include a wide variety of solar calendars, which illustrate human interaction with the landscape and an awareness of astronomy (thus the importance of dark night skies). Examples of petroglyphs that are on the National Register of Historic Places include Painted Desert Petroglyphs and Ruins Archeological District, Newspaper Rock Petroglyphs Archeological District, and Puerco Ruins and Petroglyphs.
- the area is a crossroads of trade routes, as evidenced by one of the most diverse arrays of ceramics in the U.S., as well as the presence of marine shell, obsidian, and varied architectural styles

- the cultural significance of this landscape extends from ancestral peoples through modern-day native peoples (Hopi, Zuni, Navajo, and Apache), and relates to concepts of homeland and ancestral territory

Significance Statement: The area of Petrified Forest National Park has been a research environment for more than 150 years for paleontological study, more than 100 years for archeological study, and more recently for other sciences. Research provides opportunities for education at many levels.

Fundamental resources and values:

- paleontological resources, both in their natural setting and in the museum collection
- archeological resources, both extant (described above) and in the museum collection, including an extensive sherd collection
- archives and historic photographs in museum collection
- history of the sciences of archeology and paleontology — remains of camps, historic collections, archives of journals and field notes, photos; includes work by Muir, Spier, Camp, Hough, Fewkes, Ward, Walker, Wendorf, and Ash
- access to *in situ* resources and the museum collection that has made past and ongoing study possible

Significance Statement: Petrified Forest National Park provides unparalleled opportunities for visitors to experience a colorful and scientifically important petrified forest in its natural setting; archeological resources illustrating people living in demanding environments; the expanse, wildness, and solitude of the Painted Desert; and opportunities to see pronghorn and other wildlife of the short-grass prairie. These opportunities range in level from easy to challenging.

Fundamental resources and values:

- petrified wood deposits in a natural setting (described above)
- archeological resources (described above)
- designated wilderness (described below)
- short-grass prairie ecosystem (described above)

Significance Statement: The exceptionally clear air and expansive, colorful landscapes at Petrified Forest National Park create distinctive scenic vistas.

Fundamental resources and values:

- erosional processes that shape the landscape, and geomorphological features, including the mesas, buttes, badlands, lava flows, washes, and tinajas
- various ecosystems, such as short-grass prairie, shrub steppe, riparian, and badlands
- cultural landscapes
- the renowned, colorful Painted Desert
- dark night sky
- visibility — visitors can see more than 100 miles — vast, expansive, open, and unobstructed views

Significance Statement: Petrified Forest National Park is one of the first national parks to have lands designated as part of the national wilderness preservation system. The park offers opportunities to experience an unusual variety of resources in an undeveloped setting, as well as exceptional challenge and solitude.

Fundamental resources and values:

- petrified wood deposits in a natural setting, other paleontological resources, petroglyphs, archeological sites, short-grass prairie, and the colorful Painted Desert
- lack of trails and demanding environment offer challenge and contribute to opportunities for solitude
- dark night sky
- natural soundscape

Other Important Resources and Values

The following historic resources are not fundamental or critical to achieving the park's purpose and significance, but they are also important.

- The 35th Parallel Route is listed on the National Register of Historic Places, and roughly follows a prehistoric trade route. Resources include the Beale Camel Trail and Overland Stage Route, the Whipple Expedition Route, immigrant routes to California, the Santa Fe Railroad, Route 66, stage stops, and Interstate 40.
- Important resources related to early tourism and national monument designation (1906) include New Deal projects of the Civilian Conservation Corps and Works Progress Administration, the NPS Mission 66 design initiative, and the proposed Little Colorado River National Heritage Area. Related resources that are listed on the National Register of Historic Places include the Painted Desert Community Complex Historic District and the Painted Desert Inn (also a national historic landmark). The Rainbow Forest historic landscape has been determined eligible for listing in the national register.
- Ranching, as illustrated by the Ortega and Paulsell ranches, is of local importance and contributes to the national story of ranching history.

Primary Interpretive Themes

With one of the largest and most colorful deposits of mineralized wood in the world, as well as a globally significant fossil record of early Mesozoic plants and early archosaurs, the Petrified Forest elicits a sense of wonder and discovery that invites enjoyable learning.

The richly fossiliferous exposures of the Late Triassic Chinle Formation in Petrified Forest National Park constantly yield new specimens, new data, and new knowledge of the past that continually enrich our understanding of the world in which we live.

The tranquil yet evocative scenic vistas of Petrified Forest National Park compel contemplation of the connections between self, place, and time.

The continuing importance of the park's heritage resources to associated people — The abundant evidence of use and occupancy in what might seem to some as an uninhabited land offers opportunities to explore the powerful and complex concept of "homeland." Major tangible elements of this theme are presented below. This list is in order of importance, but is not exhaustive.

- high concentration of thousands of petroglyphs and dozens of pictographs
- more than two dozen solar calendars
- an unusually diverse array of ceramics (type sherd collection, which is a representative collection of artifacts for use in instructing interpreters and in interpretive programs)
- well-preserved pithouse villages (with examples of earliest use of pottery)
- ranching history (Ortega and Paulsell ranches)
- the 35th parallel transportation corridor
    - prehistoric trade routes
    - Beale Camel Trail
    - Overland Stage Route
    - Whipple Expedition Route
    - immigrant routes to California
    - Santa Fe Railroad
    - stagecoach stops
    - CCC and WPA (New Deal history)
    - Route 66
    - Interstate 40 corridor (Interstate Highway System history)

The recovering remnant of native grassland and steppe protected in Petrified Forest National Park invites contemplation of the

value of parks as places of refuge, healing, and rejuvenation.

Special Mandates, Agreements, and Administrative Constraints

The following special mandates, agreements, and administrative constraints are specific to Petrified Forest National Park.

- Much of the new land in the expanded boundary will remain in private ownership for the foreseeable future, and ownership is complex, with small tracts, separated surface and subsurface rights, railroad construction rights, access rights, and utility rights-of-way.
- Private land in the expanded national park boundary may be acquired from willing sellers by donation, purchase with donated or appropriated funds, or exchange (Petrified Forest National Park Expansion Act of 2004).
- State land in the expanded national park boundary may be acquired with the consent of the state, in accordance with state law, by donation, purchased with donated or appropriated funds, or exchanged. If a plan for acquiring state lands has not been developed within three years of passage of the 2004 park expansion act, and if after that time state lands cannot be acquired, the secretary of the interior may enter into an agreement with the state that would allow the National Park Service to manage those lands (Petrified Forest National Park Expansion Act of 2004). NPS staff would continue to pursue a cooperative management agreement with the state of Arizona, and to update this management agreement on an as-needed basis.
- Within three years of the 2004 expansion act, a general management plan for Petrified Forest National Park was to be developed to address use and management of the acquired addition lands (Petrified Forest National Park Expansion Act of 2004). This GMP amendment is intended to meet the intent of this legislative provision.
- Grazing shall be permitted to continue on addition lands transferred to the National Park Service, subject to applicable laws, regulations, and executive orders. The secretary of interior may accept the voluntary termination of grazing permits or leases within the park (Petrified Forest National Park Expansion Act of 2004).
- Petrified Forest National Wilderness Area was one of the first designated wilderness areas in the national park system. It was designated by Congress on 23 October 1970 (84 Stat. 1105) and is composed of 50,260 acres in two separate units. The Painted Desert unit in the northern segment of the park comprises 43,020 acres, and the Rainbow Forest unit in the southeast segment of the park comprises 7,240 acres.
- A segment of Interstate 40 bisects Petrified Forest National Park from east to west and is on national park land. The highway right-of-way is managed by the Arizona Department of Transportation under an agreement with the National Park Service.
- The Burlington Northern-Santa Fe Railroad also bisects the park; the right-of-way is owned and managed by the railroad.
- Xanterra Parks and Resorts manage the concessions operation at Petrified Forest National Park under the Fred Harvey Company name. Xanterra provides the following services to visitors under a contract with the National Park Service: food service (restaurant and snack bar), gift shops, and a gasoline station/convenience store. This contract expired in 1994, but has been extended several times due to a backlog in NPS concessions contracting and new NPS concessions regulations.

- The Petrified Forest Museum Association is a cooperative entity that produces and sells books and other publications related to the park and regional natural and cultural resources. This nonprofit association currently manages three sales outlets in the park. Its proceeds are applied to projects that benefit Petrified Forest National Park, including park-related scientific research and education. The museum association operates under a memorandum of agreement with the National Park Service under authority from Congress.

Servicewide Laws and Policies

Many park management directives are specified in laws and policies guiding the National Park Service and are therefore not subject to alternative approaches. For example, there are laws and policies about managing environmental quality (such as the National Environmental Policy Act, the Clean Air Act, the Endangered Species Act, and Executive Order 11990 "Protection of Wetlands"); laws and policies governing the preservation of cultural resources (such as the National Historic Preservation Act, the Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act); and laws about providing public services (such as the Architectural Barriers Act) — to name only a few.

In other words, a general management plan (or GMP amendment) is not needed to decide that it is appropriate to protect endangered species, control exotic species, protect historic and archeological sites, conserve artifacts, or provide for access for persons with disabilities. Laws and policies have already decided those and many other things for us. Although attaining some conditions set forth in these laws and policies may have been temporarily deferred in the park because of funding or staffing limitations, the National Park Service will continue to strive to implement these requirements with or without a new GMP amendment.

The alternatives in this *General Management Plan Amendment* provide guidance on how the park will comply with servicewide laws and policies, and they will address aspects of management that are not mandated by law and policy and that must be determined through a planning process.

There are other laws and executive orders that are applicable solely or primarily to units of the national park system. These include the 1916 Organic Act that created the National Park Service; the General Authorities Act of 1970; the act of March 27, 1978, relating to the management of the national park system; and the National Parks Omnibus Management Act (1998).

The NPS Organic Act (16 *United States Code* [USC], Section 1) provides the fundamental management direction for all units of the national park system:

> [P]romote and regulate the use of the Federal areas known as national parks, monuments, and reservations . . . by such means and measure as conform to the fundamental purpose of said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

The National Park System General Authorities Act (16 USC Section 1a-1 et seq.) affirms that while all national park system units remain "distinct in character," they are "united through their interrelated purposes and resources into one national park system as cumulative expressions of a single national heritage." The act makes it clear that the NPS Organic Act and other protective mandates apply equally to all units of the system. Further, amendments state that NPS manage-

ment of park units should not "derogat[e] . . . the purposes and values for which these various areas have been established."

On March 30, 2009, President Obama signed into law H.R. 146, the Omnibus Public Lands Management Act of 2009. Title VI, Subtitle D, of the act, known as the Paleontological Resources Preservation Act, directs the secretaries of the interior and agriculture to implement a comprehensive paleontological resource management program on federal lands, including NPS lands. This act will enhance the protection, management, and scientific and public understanding of fossil resources on federal lands.

The National Park Service also has established policies for all units under its stewardship. These are identified and explained in a guidance manual entitled NPS *Management Policies 2006*.

PLANNING ISSUES

Planning issues define opportunities, conflicts, or problems regarding the use or management of public lands—in this case, the park's addition lands.

The general public; NPS staff; local, state, and federal agencies; and organizations identified several planning issues during scoping (early information gathering). These issues generally involve protection of significant resources, public access and opportunities, development, and use. The issue of climate change has also been included in this section because it is an emerging, long-term issue the park will face throughout its future.

The action alternative in this plan provides strategies for addressing these issues within the context of the park's purpose, significance, and other aspects of the foundation for planning and management. The environmental analysis (chapter 4) provides a means of measuring the alternatives' effectiveness in addressing these issues.

Protection of Paleontological and Archeological Resources

A main reason cited for expanding the national park in 2004 was to protect globally significant paleontological resources and nationally significant archeological resources (Petrified Forest National Park Expansion Act of 2004). Disturbance and looting of archeological sites, loss of fossils to erosion, and theft and removal of petrified wood have all occurred on the addition lands, and there is concern about potential vandalism or theft of petroglyphs. The National Park Service needs to decide how best to identify, protect, and preserve such sensitive resources for future generations.

Visitor Access and Recreational Opportunities

The 2004 boundary expansion area represents a huge potential area for visitor activities; however, large portions are believed to contain resources that would be vulnerable to loss or damage (inadvertent or other) from visitor activities. The National Park Service needs to determine what general level of visitor access, recreational opportunities, and visitor education/ interpretation opportunities should be provided until comprehensive planning can be done in a future general management plan for the entire park.

General Development

Existing infrastructure within the 2004 boundary expansion area consists almost exclusively of buildings, ranch roads, fences, earthen stock tanks, etc., associated with a long history of cattle ranching. The National Park Service needs to determine how to treat this infrastructure and decide what new infrastructure, if any, would be developed during the next 15 to 20 years as lands come into NPS ownership and management.

Impacts of Special Uses and Adjacent Land Uses

Much of the area in and around the park expansion area is subject to mining activities in accordance with valid existing mineral rights. Mining of petrified wood and potash on nonfederal mineral estates is of primary concern. During the past 50 years or so there has been large-scale mechanized petrified wood mining on private lands in and around the expanded park boundary, with no reclamation efforts. A 2008 study by the Arizona Geological Survey identified a world-class potash deposit in the national park and extending beyond the park expansion area (AGS 2008). Obvious potential effects of mining activities include direct loss or damage of natural and archeological resources, as well as indirect effects such as degradation of natural scenery, soundscapes, lightscapes, air quality, and water quality.

Another concern relates to development around the periphery of the park. Residential development is slowly and gradually expanding in the vicinity of the park, and a large casino development has been proposed east of the park. In areas where the landscape remains in a relatively natural state, visitors perceive the park as continuing to the horizon. In fact, this is an illusion — the scenic vistas enjoyed by park visitors do not necessarily exist as a result of scenery being preserved within the park, but rather as a result of inaction by park neighbors. The National Park Service needs to identify ways to prevent or reduce potential adverse effects on natural scenery, soundscapes, and nightscapes resulting from such development pressures.

The Petrified Forest National Park Expansion Act of 2004 permits continued grazing on land transferred to the National Park Service to the same extent as was permitted on such lands as of July 2004, subject to applicable laws and regulations. The National Park Service needs to gather information that will assist in managing grazing-related activities so that park resources and values are preserved.

Climate Change

Climate change refers to any significant changes in average climatic conditions (such as average temperature, precipitation, or wind) or climatic variability (such as seasonality or storm frequencies) lasting for an extended period of time (decades or longer). Recent reports by the U.S. Climate Change Science Program, the National Academy of Sciences, and the United Nations Intergovernmental Panel on Climate Change (IPCC 2007) provide clear evidence that climate change is occurring and will accelerate in the coming decades.

An important goal of this planning effort is to gain a better understanding of potential impacts of climate change and develop effective strategies to manage for them. Because climate change is a long-term issue that will affect the park beyond the scope of this general management plan amendment, this planning effort is intended to lay the initial groundwork to address climate change issues. In developing this planning document, three key questions were asked:

(1) What would be the contribution of the alternatives to climate change, as indicated by the amount of greenhouse gases that would be emitted under each alternative (i.e., carbon footprint)?
(2) What are the potential impacts of climate change on the park addition lands' resources?
(3) What management principles could the park adopt to reduce greenhouse gas emissions and the impacts of climate change on climate-sensitive resources?

Regarding the first question, it has been determined that the management alternatives described in this document would only emit a negligible amount of greenhouse gases that contribute to climate change. Therefore, this impact topic has been dismissed from detailed analysis. See the section titled, "Carbon Footprint" under the "Impact Topics Considered but Eliminated from Detailed Analysis" portion of chapter 3 for more information.

Regarding the second question, climate change has the potential to alter resource conditions in many different ways at Petrified Forest National Park, but the type and intensity of these changes is still uncertain. Much depends on how much temperature will rise before the effects of climate change diminish the quality of park resources. The potential influences of climate change are described under select resource topics described in chapter 3. These include paleontological resources, water resources, vegetation and wildlife, archeological resources, historic structures, and the visitor experience.

Regarding the last question, this document provides scientific-based management principles to help guide park managers in addressing future climate change impacts on park resources and to reduce greenhouse gas emissions. These principles are described under the action alternative in chapter 2.

APPROPRIATE USE

Section 1.5 of NPS *Management Policies 2006*, "Appropriate Use of the Parks," directs that the National Park Service ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 of *Management Policies 2006*, "Process for Determining Appropriate Uses," provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the Service; and
- whether the public interest will be served.

Park managers must continually monitor park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it.

From Section 8.2 of *Management Policies*: "To provide for enjoyment of the parks, the National Park Service will encourage visitor use activities that

- are appropriate to the purpose for which the park was established, and
- are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to, park resources; and
- can be sustained without causing unacceptable impacts to park resources and values.

This general management plan amendment identifies appropriate use for the addition lands in the "Action Alternative" section of chapter 2. The uses are organized into the following categories: facilities and development, public use and access, visitor opportunities, visitor education and interpretation, and special and other uses (grazing and mining, etc.).

The analysis of whether such use, and the associated necessary and appropriate impacts, can be sustained without causing unacceptable impacts to park resources and values is provided in "Chapter 4: Environmental Consequences" of this document.

RELATIONSHIP OF THIS PLAN AMENDMENT TO OTHER PLANNING EFFORTS

General Management Plan (1993) and General Management Plan Revision (2004)

The 1993 *General Management Plan* for Petrified Forest National Park provides direction for managing the pre-expansion portion of the national park. Much of the 1993 plan is still valid and in effect, although certain elements were reconsidered in a 2004 *General Management Plan Revision*. This current planning effort, the GMP amendment for the addition lands, will not undo or replace these previous planning efforts, but rather will build upon the guidance provided by those documents until such time as a future comprehensive plan for the entire expanded park can be conducted.

Land Protection Plan

Petrified Forest National Park is developing a land protection plan for the park addition lands. The land protection plan will

(1) determine what lands or land interests need to be in public ownership, and what means of protection other than fee acquisition are available to achieve the purpose of the park,
(2) inform landowners about NPS intentions for buying or protecting land through other means,
(3) help managers identify priorities for making budget requests and allocating available funds to protect resources, and
(4) identify opportunities to protect the park by cooperating with state or local governments, landowners, and the private sector.

A draft of the land protection plan was developed in 2007; this draft will be updated in consideration of the alternatives and impact analysis developed for this GMP amendment for the addition lands.

Wilderness Management Plan

The park staff is also developing a wilderness management plan for the two designated wilderness areas within the pre-expansion portion of the national park. The wilderness management plan is being developed independently of this general management amendment.

Wilderness Study for the Addition Lands

NPS *Management Policies 2006* require that all NPS lands be studied for possible inclusion in the national wilderness preservation system. Thus a wilderness study will be required for the 125,000 acres added to the park in 2004. However, because most of the addition lands are still in private ownership, the wilderness study has been deferred until a substantial portion of private lands has been acquired. Ideally, the wilderness study would be conducted in combination with a future comprehensive general management plan for the expanded park.

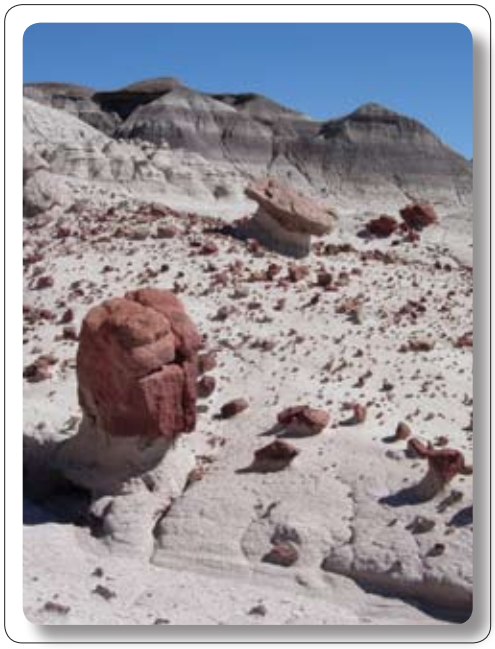
Wild and Scenic River Eligibility Assessment for the Addition Lands

NPS *Management Policies 2006* require that rivers and washes in national park units be evaluated to determine whether they are suitable for inclusion in the national wild and scenic rivers system. As part of the 2004 *General Management Plan Revision*, this was accomplished for rivers and washes located within the former park boundary. (That assessment determined that only the 1.7-mile segment of the Puerco River meets the criteria for wild and scenic river eligibility, based on the presence of the Puerco Pueblo archeological site, an "outstandingly remarkable" cultural resource value). When the park boundary was expanded in 2004, an additional 25 miles of the Puerco River as well as other washes were added to the park.

Typically, wild and scenic river eligibility assessments rely on resource management records, inventories, and other analyses related to the free-flowing character and outstandingly remarkable values of rivers. Although the NPS staff is aware of some river-related resources on the addition lands, much land remains privately owned. It may be some years before a substantial portion of the private lands can be acquired by the National Park Service, and thorough resource inventories can be conducted along river corridors. Therefore a wild and scenic river eligibility assessment for the addition lands has been deferred to the future, once information about river-related resources is more complete.

2

The Alternatives



INTRODUCTION

OVERVIEW

The Petrified Forest National Park Expansion Act of 2004 requires that a general management plan be developed to address use and management of newly acquired lands within the expanded park boundary. Because there are different approaches to managing these addition lands, the planning team investigated a range of possible management alternatives. This chapter describes how these alternatives were developed and identifies the alternative preferred by the National Park Service.

This chapter also includes the following management components that would be incorporated as part of the action alternative: (1) user capacity, (2) management principles to address climate change, and (3) mitigative measures. The environmentally preferable alternative and alternatives considered but dismissed are also described. The impacts of each alternative are summarized in table 3 (at the end of this chapter) from the information presented in "Chapter 4: Environmental Consequences— pursuant to the National Environmental Policy Act (NEPA).

HOW THE ALTERNATIVES WERE DEVELOPED

Initially, the planning team took a conventional NPS approach to develop management alternatives for the park addition lands. This approach began with developing management concepts, which make various convincing cases for the kind of place the park addition lands could be—its overall character in terms of emphasis on particular kinds of resource conditions and associated visitor experiences. Broad differences in opinion were considered during this initial planning process, resulting in the following management concepts for the addition lands:

(a) a concept that focused on building stewardship and a park constituency through recreational opportunities
(b) a concept that emphasized research and science
(c) a concept that would have maximized resource protection at the expense of other activities and visitor opportunities

However, the planning team ultimately decided to dismiss all of these concepts from detailed evaluation for a variety of reasons. The overarching reason was because the National Park Service only has full management responsibility for 12% of the addition lands, and it could be a decade or more before most of the lands are under NPS ownership or management. This constraint makes implementation of these alternative management concepts technically infeasible for the foreseeable future. For more information on why these alternatives were not carried forward, see the section of this chapter titled, "Alternatives Considered but Dismissed from Detailed Evaluation."

Instead, only one action alternative was developed to provide a more practical, interim approach to managing lands as they come into NPS ownership. The method used to fully develop the action alternative follows NPS planning guidelines. It is based on the park's purpose, significance, fundamental resources and values, special mandates, and other aspects of the foundation for planning and management described in chapter 1. The action alternative is also designed to address the planning issues identified during scoping — also found in chapter 1.

The action alternative is compared to the no-action alternative, which is a continuation of current management. The no-action alternative is included as a baseline against which to compare the effects of the action alternative. These two alternatives for managing the park addition lands for the next 15 to 20 years are described in detail. Both the

no-action and action alternatives include the following components for comparative purposes:

- natural resource management
- cultural resource management
- research
- facilities and development
- administrative access
- public use and access
- park visitor opportunities
- park visitor education and interpretation
- special and other uses
- future plans and studies
- partnerships
- commercial services
- park boundary adjustments
- staffing and costs

IDENTIFICATION OF THE NPS PREFERRED ALTERNATIVE

The action alternative has been identified by the National Park Service as the agency's preferred alternative, providing the greatest advantage to the park. It was identified by comparing the relative advantages of each alternative and was found to provide the most practical, interim approach to managing the addition lands as they come into NPS ownership.

One of the greatest advantages to the action alternative is its cautious approach to use of the area before resource inventories and condition assessments are complete. For example, although visitor opportunities would not happen immediately under the action alternative, they would be considered pending evaluation of the addition lands to determine which areas can sustain recreational use without resource damage. As a whole, the action alternative provides the best combination of interim management approaches for protecting globally significant resources while considering the area for appropriate future uses.

THE NO-ACTION ALTERNATIVE (CONTINUE CURRENT MANAGEMENT)

OVERVIEW

The no-action alternative is included as a required baseline against which to compare the actions in and effects of the action alternative. Most of the addition lands have been managed as part of large cattle ranches since the late 1800s; lands are currently a mix of private (59%), state (29%), and NPS (12%) ownership. The NPS lands, most of which were managed by the Bureau of Land Management until 2007, and the state lands have also traditionally been leased for grazing. Under this alternative, the addition lands would remain a mix of private, state, and NPS ownership and management. The NPS proportion would be relatively small, consisting of former BLM lands and recently acquired private lands.

No management zones are proposed for the addition lands in this alternative. The no-action alternative is a continuation of current management and no zones are used in the ongoing management of these lands. The No-action Alternative map shows management zones for the pre-2004 park and none for the addition lands.

NATURAL RESOURCE MANAGEMENT

The National Park Service would continue to survey the 12% of the addition lands that are owned by the National Park Service for paleontological resources, and it would collect important fossils that are threatened by erosion and exposure for preservation and study. Assuming continued permission by the state, NPS staff would continue to do the same on the 29% of the addition lands that are owned by the state, but this would be limited by staffing, access, and other constraints. There would be no systematic paleontological surveys on the addition lands that are in private ownership (59%), although some landowners might authorize paleontological surveys on their land. Other than this, proactive management or protection of paleontological resources, including fossils and petrified wood, would likely be minimal. Legal mining and removal of petrified wood would likely continue on some private lands.

Natural plant and animal communities would continue to exist in their current state on the addition lands. Although some private landowners would continue to manage their lands in a manner consistent with the conservation of natural resources, privately owned addition lands would not necessarily be managed for that purpose. Established nonnative invasive plant populations (e.g., salt cedar and Russian thistle) would continue to exist, especially along the Puerco River corridor, near earthen water impoundments called stock tanks, and in other areas that are disturbed or have a history of human uses. Hay is imported onto ranchlands, and this would continue to be a potential source of weedy plant populations. Stock tanks would continue to exist on the addition lands. Wildlife is drawn to these tanks because they are one of the only year-round open water sources in this desert environment.

Fences that separate land parcels within the addition lands would continue to inhibit natural movements of some wildlife species, such as pronghorn antelope.

CULTURAL RESOURCE MANAGEMENT

Because the National Park Service does not own most of the addition lands, there could be no cultural resources inventories and no cultural resources management program for the addition lands — except for the small proportion of NPS-owned lands. There would be no systematic identification, evaluation, or protection of historic structures, cultural landscapes, archeological resources, or ethnographic resources.

Although some private landowners do their best to conserve known archeological resources on their land, they are not required to do so. Despite the best efforts of many, archeological sites on state, private, and federal lands would likely continue to deteriorate, be disturbed, or be lost because of trampling, vandalism, and natural forces. The few structures and landscapes that may be historic would continue to deteriorate from lack of maintenance and preservation, and possibly from vandalism.

RESEARCH

A very limited amount of academic research would likely take place on private lands; such research has been conducted rarely in the past and has been focused on specific aspects of geology, paleontology, and archeology. Findings from research conducted on private lands do not necessarily become public knowledge. Some limited geologic, paleontological, and archeological research would also be conducted on the NPS- and state-owned lands.

FACILITIES AND DEVELOPMENT

Under the no-action alternative, development would remain limited to existing infrastructure associated with cattle ranching, including unimproved ranch roads, barbed-wire fences, stock tanks, scattered windmills, and isolated clusters of ranch buildings and corrals. Such facilities would continue to be maintained at the discretion of landowners. The ranch roads would be used occasionally by authorized users; some are deteriorating from lack of regular use and maintenance. Similarly, some stock tanks are no longer being maintained because of the discontinuation or reduction of grazing.

ADMINISTRATIVE ACCESS

NPS staff would be able to access NPS lands where such access does not require crossing private or state land. NPS access to state lands would continue as permitted under NPS-state agreements. This means that NPS staff would have administrative access to state lands for specific management purposes unless such access would require crossing private lands. In this case, NPS access across private land would occur only with permission from private landowners.

PUBLIC USE AND ACCESS

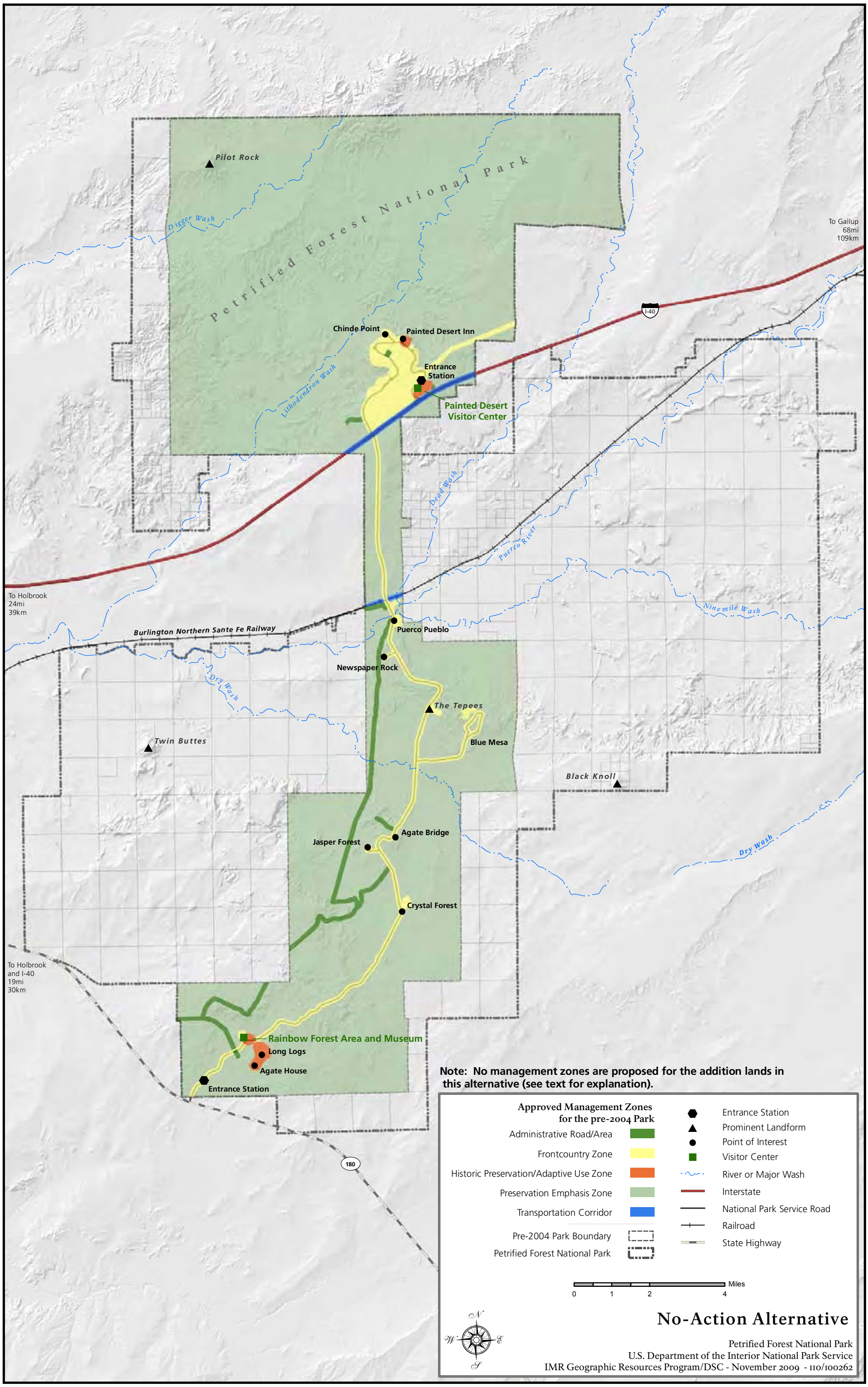
Because of the "checkerboard" private, state, and federal ownership pattern, there would continue to be no general public access on the addition lands under the no-action alternative. Use and access for activities such as hunting on private lands or research would occur only with specific permission from landowners.

PARK VISITOR OPPORTUNITIES

There would continue to be a lack of access and on-site opportunities for park visitors on the addition lands under the no-action alternative. The addition lands would continue to be identified on the Petrified Forest National Park brochure as "No access — private lands within authorized park boundary." However, because the addition lands form much of the visual backdrop to the pre-expansion national park, park visitors would still be able to see the addition lands from various designated and informal viewpoints.

PARK VISITOR EDUCATION AND INTERPRETATION

Limited educational and interpretive information about the addition lands would continue to be provided to park visitors by the National Park Service. This information would be provided primarily within the pre-2004 national park.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Dry Wash
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To Holbrook
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Burlington Northern Sante Fe Railway
Puerco Pueblo
Newspaper Rock
The Tepees
Blue Mesa
Twin Buttes
Black Knoll
Agate Bridge
Jasper Forest
Crystal Forest
To Holbrook
and I-40
19mi
30km
Rainbow Forest Area and Museum
Long Logs
Agate House
Entrance Station
180
Note: No management zones are proposed for the addition lands in this alternative (see text for explanation).
Approved Management Zones for the pre-2004 Park
Administrative Road/Area
Frontcountry Zone
Historic Preservation/Adaptive Use Zone
Preservation Emphasis Zone
Transportation Corridor
Pre-2004 Park Boundary
Petrified Forest National Park
Entrance Station
Prominent Landform
Point of Interest
Visitor Center
River or Major Wash
Interstate
National Park Service Road
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SPECIAL AND OTHER USES (GRAZING, MINING, ETC.)

There is a long history of cattle ranching on the addition lands, and this would continue under the no-action alternative. Three of the four grazing allotments on the addition lands had active cattle grazing as of 2008. (See Grazing Allotments map for a description of these allotments.) Grazing on the southwestern allotment was discontinued in 2002, but cattle could be reintroduced to this allotment at any time at the discretion of the grazing lease holder. The intensity of grazing on each allotment would continue to vary according to the management preferences of the allotment holders, within the conditions allowed by the grazing leases.

Petrified wood and basalt cinder mining would likely continue within the addition area on privately owned lands in a limited number of locations. Petrified wood and basalt cinders are classified as minerals by the state of Arizona, and they can be legally mined by those who hold valid existing mineral rights.

Some private development of residences or ranchettes would also probably occur on private lands, although the extent would likely remain very limited and the pace would remain slow because of the lack of vehicular access and utilities such as water and electrical power.

Hunting would likely continue on a limited basis on private lands (permission of the landowner is required) and state lands (permit is required). Hunting would not occur on NPS-owned lands because hunting is not permitted in national parks unless specifically authorized by Congress.

Land uses on the addition lands have been many and varied over the past century or so. Evidence of such uses, such as abandoned vehicles, trailers, tire and garbage dumps, water tanks, and miscellaneous materials (such as batteries, oil and pesticide containers) would continue to exist in some locations.

FUTURE PLANS AND STUDIES

No new future plans or studies would be proposed under the no-action alternative.

PARTNERSHIPS

Petrified Forest National Park staff would continue to work on a limited basis with the state of Arizona and with private landowners to address goals and issues of mutual interest related to the addition lands.

COMMERCIAL SERVICES

No commercial services would be provided within the addition lands.

PARK BOUNDARY ADJUSTMENTS

No boundary adjustments would be proposed under the no-action alternative.

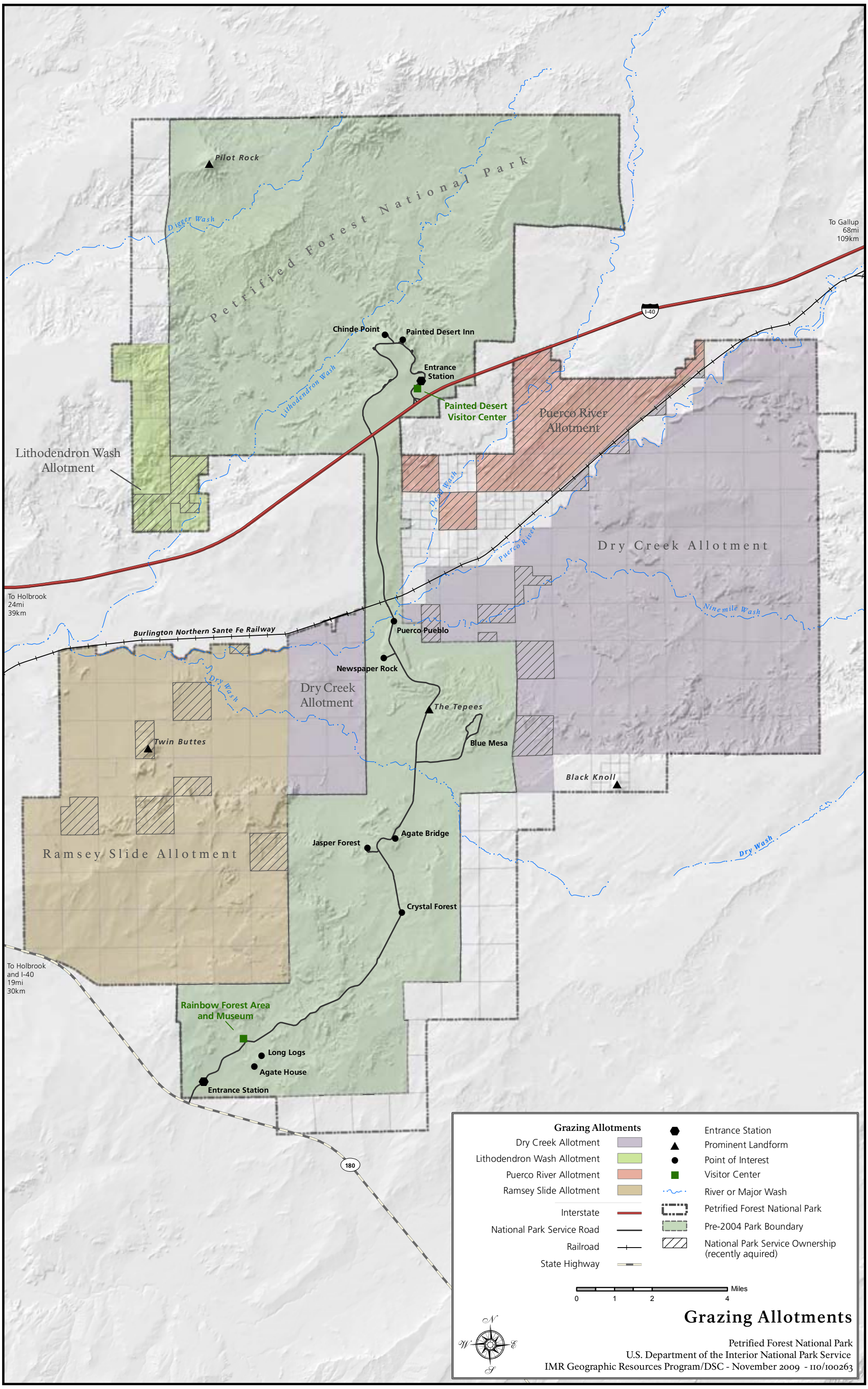
STAFFING AND COSTS

Under the no-action alternative, Petrified Forest National Park would continue to be staffed at the 2008 level: 53 full-time-equivalent employees or "FTE" employees. Volunteers and partnerships would continue to be key contributors to NPS operations.

The cost of this alternative is estimated at $592,200, which is for resource inventories on lands within NPS management jurisdiction as of December 2008 (approximately 15,200 acres). Annual operating costs for the no-action alternative would be $3.54 million. More information on costs is provided in table 3 later in this chapter.

The cost figures in this plan are intended only to provide an estimate of the relative costs of the alternatives. NPS and industry cost estimating guidelines were used to develop the costs (in 2008 dollars) to the extent possible,

but the estimates should not be used for budgeting purposes. Specific costs will be determined in subsequent, more detailed planning and design efforts. Actual NPS costs will vary depending on if and when the actions are implemented, and on contributions by partners and volunteers. The approval of this general management plan amendment does not guarantee that funding and staffing needed to implement the plan will be forthcoming. Full implementation of the plan could be many years in the future. Implementation of the approved plan would depend on future NPS funding levels and agency priorities, and on partnership funds, time, and efforts.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Interstate
National Park Service Road
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Prominent Landform
Point of Interest
Visitor Center
River or Major Wash
Petrified Forest National Park
Pre-2004 Park Boundary
National Park Service Ownership (recently aquired)
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Grazing Allotments
Petrified Forest National Park
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THE ACTION ALTERNATIVE

OVERVIEW

Once private parcels in the addition lands are acquired by the National Park Service from willing sellers, ownership and management would either be all National Park Service or it would be a mix of NPS and state ownership, with state lands being cooperatively managed. The action alternative describes the NPS preferred management approach for addition lands that come into NPS management (or co-management with the state) over time. Until such time as private lands can be acquired by the National Park Service from willing sellers, the Park Service would consider additional strategies (e.g., conservation easements, public recreational access easements, partnerships, and/or other cooperative efforts — all with willing private landowners) for conserving high-priority parcels and for providing appropriate public access.

The National Park Service would manage the addition lands cautiously while gathering as much information about them as possible during the next 15 to 20 years. Initial priorities would be to conduct resource inventories, condition assessments, and research to increase NPS and public understanding of these lands. Opportunities for visitors to experience the addition lands would be made available. Sensitive resources would be preserved and/or rehabilitated as necessary, with particular emphasis on paleontological and archeological resources (the addition lands were added to the park primarily for their paleontological and archeological significance). Actions would avoid degrading wilderness characteristics, pending completion of a future required wilderness study for the addition lands.

DESIRED FUTURE CONDITIONS RELATED TO THE ADDITION LANDS

- The National Park Service builds and maintains excellent relationships with private inholders and with neighboring landowners and land managers.
- The National Park Service understands the extent, nature, and condition of addition lands resources, especially paleontological, archeological, and biological resources.
- Addition lands resources, especially paleontological and archeological resources, are preserved and protected.
- Park visitors understand why the addition lands are so special that the authorized park boundary was expanded to include them.
- Park visitors eventually have first-hand opportunities to see and experience the addition lands.
- The National Park Service eventually acquires management jurisdiction for all addition lands.
- The addition lands' wilderness character and wilderness eligibility is retained until a future wilderness study determines how much land, if any, should be proposed for wilderness designation.

MANAGEMENT ZONES FOR THE ADDITION LANDS

Management zones prescribe how the National Park Service would manage different areas of the national park. Each management zone specifies complementary natural resource conditions, cultural resource conditions, opportunities for visitor experiences, and types and levels of facilities. Typically in the Park Service, several different management zones are applied to geographic locations on a map of the park to indicate the management emphasis for each area. However, because relatively little is known about the Petrified Forest addition lands, the planning team has recommended only two management zones for this area: the **transportation corridor zone** (borrowed from the 2004 *General Management Plan*

Revision) and the **inventory and interim protection zone** (new).

The Action Alternative map shows how the park would be managed according to these zones once the private lands are acquired by the National Park Service (or, in the case of state lands that are not acquired by the National Park Service, once there is a long-term cooperative management agreement in place). The National Park Service recognizes valid existing rights of private landowners and the state of Arizona, including grazing and mineral rights; the management zones on the Action Alternative map are not intended to imply otherwise. The transportation corridor zone would be applied to the I-40 and State Route 180 road rights-of-way and the Burlington Northern-Santa Fe railroad right-of-way. The inventory and interim protection zone would be applied to all other lands within the 2004 park expansion area. These zones are described below.

Transportation Corridor Zone

Resource Condition. This zone is for corridors where highway or rail traffic moves across the park along highway or railway rights-of-way. Park landscapes and soundscapes may be substantially affected. The National Park Service is actively engaged in protecting wildlife and scenic vistas, managing native vegetation, and minimizing pollution and litter within these corridors, but NPS management is limited due to the rights-of-way and associated uses.

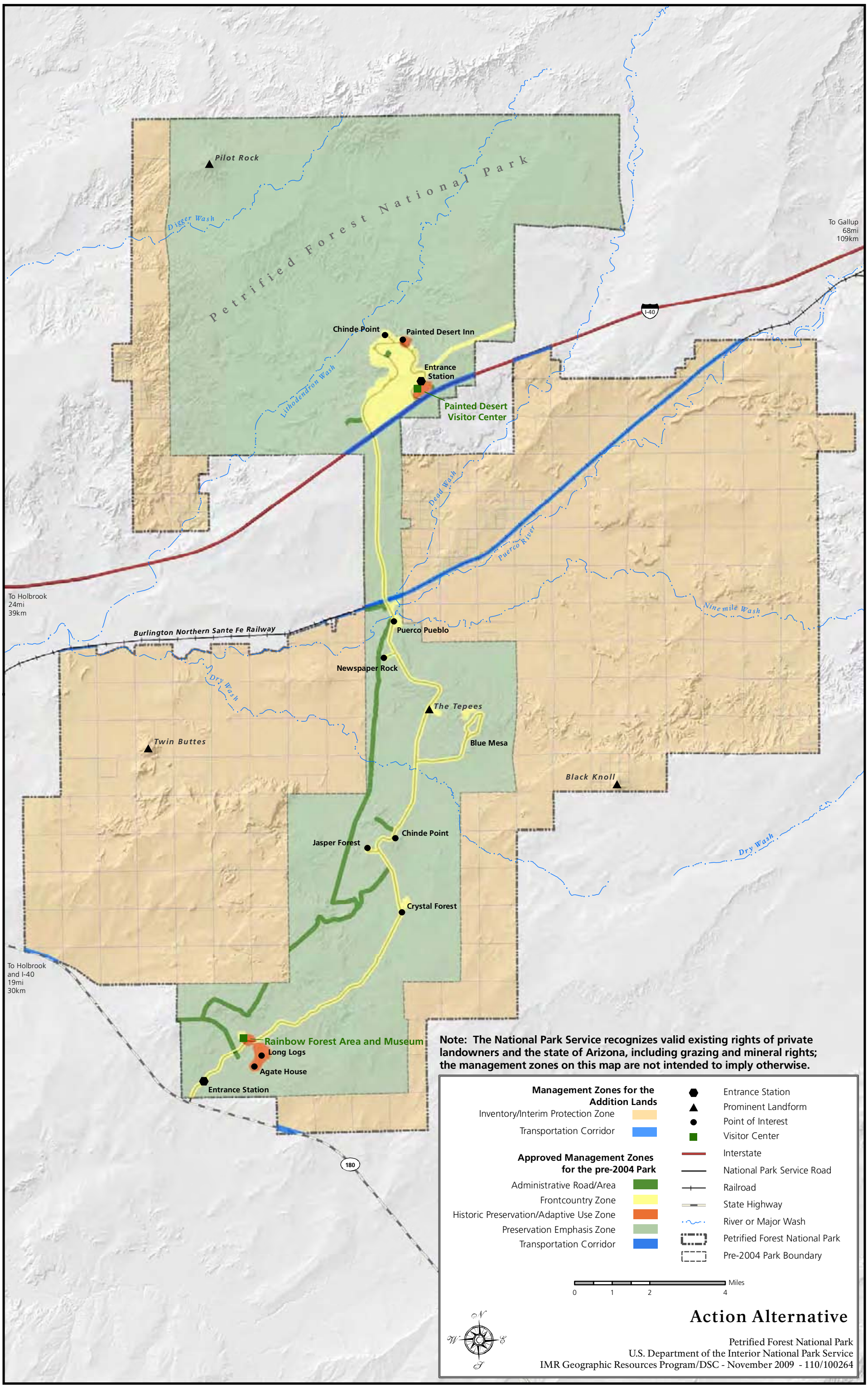
Visitor Experience and Appreciation. Highway corridors are visitors' major routes of approach and access to the park. A key NPS goal is for travelers to understand park boundary locations and the significance of the park.

Facilities and Activities. Most travelers along I-40 pass incidentally through the park without stopping. Onboard interpretation may be provided on passenger trains; however, most rail traffic on the Burlington Northern-Santa Fe railway is freight. Facilities, most of which are non-NPS, include four-lane highways, railroads, embankments, bridges, ramps, signs, and culverts. NPS management activities include promoting visitor appreciation and understanding of the park, cooperating with other entities for management, mitigating harmful impacts, managing safety, and providing emergency response.

Inventory and Interim Protection Zone

Resource Condition. Lands in this zone have recently been acquired by the National Park Service, or, in the case of former BLM lands or state lands, have recently come into NPS management. The current condition of natural and cultural resources ranges from well preserved, to unmaintained, to poor and/or highly disturbed; these conditions are largely a reflection of past land uses, human activities, and natural processes. Desired conditions range from unimpaired and generally unaffected by human influences to restored or rehabilitated to the extent possible. This is based on natural and cultural resource values and the potential to reverse resource degradation or restore resources.

Visitor Experience and Appreciation. Visitors have opportunities to experience and learn about the addition lands. These opportunities are those that the National Park Service can safely make available with legal access, without risk of resource damage, and without rendering lands ineligible for wilderness consideration. For resource protection reasons there may be permit requirements or limits on group size. Park staff and vehicles may occasionally be encountered. Access may be limited by noncontiguous NPS ownership, road conditions, and physical barriers such as railroads and washes. Interpretative and educational opportunities would take place mostly off the addition lands, but there could also be some opportunities (e.g., guided tours) on the addition lands. Interpretive and educational opportunities would be enhanced over time through knowledge gained from addition lands research and inventories.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Note: The National Park Service recognizes valid existing rights of private landowners and the state of Arizona, including grazing and mineral rights; the management zones on this map are not intended to imply otherwise.
Management Zones for the Addition Lands
Inventory/Interim Protection Zone
Transportation Corridor
Approved Management Zones for the pre-2004 Park
Administrative Road/Area
Frontcountry Zone
Historic Preservation/Adaptive Use Zone
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Petrified Forest National Park
Pre-2004 Park Boundary
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Facilities and Activities. Management emphasizes resource protection and stabilization; collecting baseline information about the location, type, and condition of natural and cultural resources (e.g., petrified wood and other fossils, vegetation, archeological sites, and historic structures) is a high priority. Visitor activities include hiking and back-country camping in designated areas and interpretive or educational tours. Any new hiking trails are carefully sited, and vehicular access is likely to be on existing routes. New facilities are minimal (e.g., restrooms, patrol cabins, or entrance kiosks) and carefully sited to avoid rendering areas ineligible for future wilderness consideration. Livestock grazing and mineral exploration/ extraction may occur as allowed by the 2004 park expansion legislation and other valid existing rights.

NATURAL RESOURCE MANAGEMENT

Once the National Park Service has management jurisdiction (through acquiring non-federal lands from willing sellers, by a management agreement for state lands, or by interim agreements such as conservation easements), the agency would conduct comprehensive baseline inventories for paleontological resources, such as petrified wood and other fossils. Important fossils that are threatened by erosion and exposure would also be collected for preservation and study.

The National Park Service would also conduct comprehensive baseline inventories for other natural resources, such as vegetation, wildlife, streams, springs and seeps, and invasive exotic species. Condition assessments for specific resources (vegetation, riparian corridors, etc.) would also be conducted. As new information is collected, the National Park Service would extend maps of vegetation, soils, and geology to include the addition lands. High-priority trouble spots that require immediate treatment and restoration, such as concentrations of invasive exotic species and severely disturbed sites, would be identified and addressed.

Once they are no longer needed, the National Park Service would remove fences that inhibit natural wildlife movements.

CULTURAL RESOURCE MANAGEMENT

The National Park Service would conduct baseline surveys and condition assessments for archeological sites on the addition lands once management jurisdiction is acquired. This would include ancestral Pueblo sites, petroglyphs, and historic archeological sites, among others. The agency would also inventory and evaluate potential historic structures, sites, and landscapes for eligibility for listing in the National Register of Historic Places. The agency would also work to identify ethnographic resources and allow tribal access to sites of traditional, religious, subsistence, or other significance according to NPS management policies.

Potential historic structures (e.g., the Pinta station and a possible historic stagecoach stop) would be stabilized until such structures could be evaluated for national register eligibility and decisions could be made about their long-term treatment.

RESEARCH

The National Park Service would direct, conduct, and encourage research that expands park and public knowledge and understanding about park resources, with special emphasis on archeology and paleontology. Research that contributes to management decision-making would be promoted, such as undertaking a study to learn more about benefits and impacts of existing stock tanks (e.g., how wildlife use the tanks), and research to better understand the Puerco River riparian system, including surface water and ground water hydrology.

FACILITIES AND DEVELOPMENT

The National Park Service would conduct a thorough inventory of existing infrastructure (e.g., roads, buildings, fences, stock tanks) once management jurisdiction of the addition lands is acquired from willing sellers. The National Park Service would consider temporary adaptive uses for existing structures as they come into NPS ownership. Longer term infrastructure and development decisions would be made in a future comprehensive general management plan / wilderness study that addresses management of the pre-2004 park and the addition lands holistically (see "Future Plans and Studies" section below). Pending completion of such a future plan, any new facilities developed by the Park Service would be minimal (e.g., restrooms, small patrol cabins, or entrance kiosks) and would be carefully sited to avoid rendering areas ineligible for wilderness consideration. Any new hiking trails would be carefully sited and would use existing trails and ranch roads to the extent possible. Similarly, vehicular routes for administrative use would be unimproved and would use ranch roads as much as possible. Based on the evaluation of stock tanks, NPS staff would determine, in cooperation with grazing leaseholders, who should maintain stock tanks over the short term. Longer-term decisions about whether to maintain stock tanks would be made based on a study of their costs and benefits (see "Future Plans and Studies" section below).

ADMINISTRATIVE ACCESS

The National Park Service would evaluate existing and potential routes to better understand opportunities for administrative access, and it would use such routes where resource, safety, cost, and legal considerations allow. Pending completion of a future wilderness study, administrative routes would remain unimproved and limited to those necessary for critical management activities. Ranch roads that are not needed for management purposes would be closed and allowed to return to more natural conditions.

PUBLIC USE AND ACCESS

Following acquisition of management jurisdiction, the National Park Service would evaluate existing routes and resource protection considerations to better understand opportunities for visitor access. Nonmotorized, nonmechanized public access would be allowed on such routes where resource, safety, cost, and legal considerations allow. Pending completion of a future comprehensive general management plan / wilderness study, routes for public access would remain unimproved to avoid rendering areas ineligible for wilderness consideration.

PARK VISITOR OPPORTUNITIES

Initially, the National Park Service would identify areas that can sustain visitor use without resource damage. Visitor use would then be allowed and encouraged as appropriate given access, resource, and safety considerations, and without precluding wilderness eligibility. Examples of recreational opportunities that would be considered include extended hiking and backcountry camping opportunities in designated areas and interpretive and educational programs.

PARK VISITOR EDUCATION AND INTERPRETATION

Visitor education and interpretive opportunities would be provided for visitors to learn about the addition lands. These would include self-guided and guided on-site opportunities (e.g., interpretive tours), as well as off-site opportunities (e.g., programs conducted or information provided in the main park visitor centers).

SPECIAL AND OTHER USES (GRAZING, MINING, ETC.)

In accordance with valid existing rights and applicable laws, the National Park Service

would allow continued livestock grazing in a manner that minimizes impacts on park resource and values. As opportunities arise, the agency would accept voluntary termination of grazing permits or leases, per the Petrified Forest National Park Expansion Act of 2004.

Similarly, the agency would work with owners of mineral rights to avoid or reduce the potential negative effects on park resources resulting from mining-related activities. This would be accomplished in accordance with valid existing rights and applicable laws. If the agency determines that effects on resources cannot be avoided or adequately reduced, authorization would be sought to acquire mineral rights.

In keeping with NPS management policies and federal laws, hunting would be prohibited on NPS-owned lands.

In general, hazardous materials would be identified and removed before NPS acquisition of land parcels. Once lands are under NPS management jurisdiction, the agency would identify and address serious safety hazards, clean up dump areas if cleanup cannot be negotiated and accomplished before NPS takes possession, and recycle materials if possible.

FUTURE PLANS AND STUDIES

High-priority future inventories, studies, assessments, mapping efforts, and plans that would be needed are listed below:

Inventories

- fossil inventory
- petrified wood inventory
- inventory of archeological sites
- vegetation inventory, including exotic invasive plants
- Puerco River riparian area inventory
- wildlife inventory (mammals, birds, reptiles, amphibians)
- inventory of springs and seeps
- inventory of potential historic structures and cultural landscapes
- inventory of disturbed sites and abandoned materials
- inventory of infrastructure (ranch roads, fences, features, etc.)
- inventory abandoned mine lands

Studies and Assessments

- vegetation/rangeland condition assessment
- water quality assessment
- study of Puerco River groundwater and surface water hydrology
- study of the benefits and costs of stock tanks
- assessment of archeological site conditions
- safety hazard assessment
- infrastructure condition assessment
- viewshed study (to determine potential locations for viewpoints that would not eventually be compromised by development outside the expanded park boundary)
- ethnographic survey
- cultural landscape report (if inventories identify a need)
- evaluate museum collections storage facilities and partnerships

Mapping Efforts

- boundary survey and marking
- expand vegetation map to cover the addition lands
- expand geologic map to cover the addition lands
- expand soils map to cover the addition lands
- document the extent of grazing as of 2004 when the park was expanded

Future Plans

The following plans would be conducted once the National Park Service has assumed management responsibility for most of the

addition lands and has completed key baseline inventories and condition assessments:

- a comprehensive general management plan for the entire Petrified Forest National Park (pre-expansion park plus addition lands, considered holistically)
- a wilderness study for the addition lands. (According to NPS *Management Policies 2006*, "All NPS lands will be evaluated for their eligibility for inclusion within the national wilderness preservation system"; the pre-expansion portion of the park has already been evaluated.)
- a wild and scenic river eligibility assessment for rivers/washes within the addition lands (The pre-expansion portion of the park has already been evaluated.)

PARTNERSHIPS

NPS staff would collaborate with park neighbors (e.g., tribes; private landowners; developers; and other local, regional, and state entities) to achieve common goals and to protect park resources and values, including viewsheds, night skies, and soundscapes.

NPS staff would continue to pursue a cooperative management agreement with the state of Arizona, and update this management agreement on an as-needed basis.

Collaboration with the Bureau of Land Management would also continue, especially regarding the administration of four grazing permits within the park addition lands, which were transferred from the Bureau of Land Management to the National Park Service in 2007.

COMMERCIAL SERVICES

No commercial services would be provided within the addition lands during the life of this GMP amendment.

PARK BOUNDARY ADJUSTMENTS

No boundary adjustments would be proposed under the action alternative; this GMP amendment is focused exclusively on management of lands within the 2004 boundary expansion area.

STAFFING AND COSTS

Under the action alternative, Petrified Forest National Park would be staffed at 62 full-time-equivalent (FTE) staff members, an increase of nine FTE staff over the 2008 staffing level. These staff members would likely be allocated similar to the following:

- 3 FTE employees in the resource management division for inventory, data management, range conservation, and geographic information systems
- 3 FTE employees in the visitor and resource protection division for patrol and enforcement, resource monitoring, and management of mineral and grazing activities
- 1 FTE employee in the maintenance division for infrastructure maintenance and clean up
- 1 FTE employee in park management for project planning/management and partnership support
- 1 FTE employee in interpretation for development and delivery of interpretive and educational programs

Volunteers and partnerships would continue to be key contributors to NPS operations.

The cost of the action alternative is estimated at $6.6 million for resource inventories, condition assessments, mapping efforts, etc. for some 125,000 acres (essentially the entire addition lands area). Annual operating costs for the action alternative would be $4.44 million. More information on costs is provided in table 3 later in this chapter.

The cost figures in this plan are intended only to provide an estimate of the relative costs of alternatives. NPS and industry cost-estimating guidelines were used to develop the costs (in 2008 dollars) to the extent possible, but the estimates should not be used for budgeting purposes. Specific costs will be determined in subsequent, more detailed planning and design efforts. Actual costs to the National Park Service will vary depending on if and when the actions are implemented, and on contributions by partners and volunteers. The approval of this general management plan amendment does not guarantee that funding and staffing needed to implement the plan would be forthcoming. Full implementation of the plan could be many years in the future. Implementation of the approved plan, no matter which alternative, would depend on future NPS funding levels and agency priorities, and on partnership funds, time, and effort.

USER CAPACITY

General management plans for national park units are required by law to identify and address implementation commitments for user capacity, also known as carrying capacity. The National Park Service defines user capacity as the types and extent of visitor use that can be accommodated while sustaining the quality of park resources and visitor experiences consistent with the purposes of the park. Managing user capacity in national parks is inherently complex and depends not only on the number of visitors, but also on where they go, what they do, and the "footprints" they leave behind. In managing for user capacity, the park staff and partners rely on a variety of management tools and strategies, rather than relying solely on regulating the number of people in a park or simply establishing limits on visitor use. In addition, the ever-changing nature of visitor use in parks requires a deliberate and adaptive to approach to user capacity management.

As part of the National Park Service's commitment to implement user capacity, this management plan amendment addresses user capacity in the following ways:

- It describes the overall direction for allowing visitor use on the Petrified Forest National Park addition lands (see management zones and action alternative sections on public use and access, visitor opportunities, and facilities and development). As already outlined, visitor use on the addition lands would be approached cautiously, and provisions for visitor use would be made only after sufficient information is collected about the resources in the area. When considering where to provide for and encourage visitor use, the National Park Service would take into account the issues of legal access, risk of resource damage, and the need to preserve the land's wilderness character until the potential for wilderness is evaluated. Already disturbed areas, or areas where resources are less sensitive, would be considered first for new visitor opportunities. Given the sensitivity of resources on the addition lands, some new visitor opportunities may only be by park guide or permit (until resource conditions are further assessed). Over the longer term, as information is gathered and future planning efforts direct the appropriate placement of visitor facilities (if needed), more diverse visitor activities may be permitted. This overall strategy for allowing and managing visitor use on the addition lands is the most important implementation commitment for user capacity in this management plan.
- Potential user capacity-related concerns are described (see second paragraph below).
- Potential indicators and standards and consideration for monitoring are included (see appendix B) to more clearly define and draw attention to potential user capacity-related concerns that may develop as visitors begin using the addition lands. Given the limited knowledge of resources and specific direction on how visitors will access the addition lands, highly specific and measurable indicators and standards were not developed as part of this management plan, but will be further defined as part of future planning efforts.
- Potential management strategies are outlined (see appendix B) that could be considered to prevent or minimize key impacts from visitor use.

This approach is not intended to be complete and final; rather the park staff will abide by these directives for guiding the types and extent of visitor use that will be accommodated on the addition lands as the lands come into NPS ownership and as more becomes known about them. Further elaboration and adaption of this approach will be developed in a user capacity implementation plan, as

suggested in the 2004 *General Management Plan Revision*, or alternatively in a future comprehensive general management plan / wilderness study. Regardless, final selection of measurable indicators and standards for monitoring purposes, and implementation of management actions that affect use, would comply with the National Environmental Policy Act (1969), Section 106 of the National Historic Preservation Act, and other laws and NPS management policies as appropriate.

The most pressing use-related concern within the pre-2004 park boundary and potentially the addition lands is the loss and disturbance (including theft) of nonrenewable resources, specifically petrified wood, other fossils, and archeological resources. Minor off-trail resource impacts (vegetation trampling and soil disturbance), and occasional incidences of crowding and congestion are issues on the existing park lands, and may be of concern on the addition lands once visitation increases. Addressing user capacity regarding nonrenewable resources such as petrified wood and archeological resources is especially challenging because such resources cannot "rebound" or recover.

On the current park lands, more than 12 tons of petrified wood is moved or removed per year, with 70% of the theft or disturbance occurring within 10 feet of parking areas and along trails (Chandool 1997). Note that petrified wood can be moved/removed in various ways, including removal of an entire log, theft of large and small pieces, and the movement of pieces from one place in the park to another place in the park. The physical integrity and the integrity of the geologic contexts in which paleontological resources occur are critical to their scientific and educational values. Human use that results in the disturbance or loss of nonrenewable paleontological resources, or the geologic strata that surround them, would diminish the ability to understand and interpret the resource values of this fundamental resource. These same concerns apply to the park's important archeological resources.

Future planning for the location and distribution of visitor use opportunities on the addition lands must carefully consider the park staff's extensive experience on the existing park lands (with managing the disturbance and theft of paleontological and archeological resources) and relevant visitor research to better assess and minimize impacts. Some of the management strategies already undertaken, with varying degrees of success, have included stationing rangers at high-theft sites, increased patrols, placing fences or barriers along trails, giving free samples of petrified wood collected outside the national park, and increasing personal contact and educational programs. According to visitor research conducted in the park, uniformed personnel and interpretive signs were most useful for deterring theft of nonrenewable resources (Chandool 1997). Table B-1 in appendix B relates such management actions to the anticipated most pressing user capacity concerns for the addition lands.

MANAGEMENT PRINCIPLES TO ADDRESS CLIMATE CHANGE

Climate change has the potential to adversely affect the future resource conditions of the park addition lands. As global and regional climates continue to change, a management approach that enhances the protection and resiliency of climate-sensitive resources is becoming increasingly important. The following outlines such a strategy that adapts to our growing understanding of climate change influences and the effectiveness of management to contend with them.

Climate change science is a rapidly advancing field, and new information is continually being collected and released; yet the full extent of climate change impacts on resource conditions is unknown. As such, park managers and policy makers have not determined the most effective response mechanisms for minimizing impacts and adapting to change. Because of this, this proposed management strategy does not provide definitive solutions or directions; rather it provides science-based management principles to consider when implementing the broader management direction of the action alternative.

Many of these principles are adapted from the publication, "Some Guidelines for Helping Natural Resources Adapt to Climate Change" (Baron et. al. 2008). Further elaboration and adaption of these principles are anticipated as implementation of the general management plan proceeds.

The following management principles address climate change.

- Identify key resources and processes that are at risk from climate change.
- Establish baseline resource conditions, identify thresholds, and monitor for change.
- Assess, plan, and manage resources at multiple scales (i.e., site-specific and park-wide).
- Increase reliance on adaptive management to minimize risks to park resources.
- Form partnerships with other resource management entities to maintain regional habitat connectivity and refugia that allow species dependent on park resources to better adapt to changing conditions.
- Use best management practices to reduce human-caused stresses (e.g., park infrastructure and visitor-related disturbances) that hinder the ability of species or ecosystems to withstand climatic events.
- Restore key ecosystem features and processes to increase their resiliency to climate change.
- Reduce or mitigate greenhouse gas emissions associated with park operations and visitor use (i.e., the park's carbon footprint).

MITIGATIVE MEASURES FOR THE ACTION ALTERNATIVE

The National Park Service defines mitigation as a modification of the proposal or alternative that lessens the intensity of its impact on a particular resource.

NPS staff routinely evaluate and implement mitigative measures whenever conditions occur that could adversely affect the sustainability of national park system resources. To ensure that implementation of the action alternative protects natural and cultural resources and the quality of the visitor experience, a set of mitigative measures would be applied to actions proposed under this alternative.

Because of the action alternative's emphasis on the inventory and interim protection of park resources, standard mitigation associated with proposed developments does not apply. Rather, the following mitigative measures and best management practices have been developed to avoid or lessen the impacts associated with on-going or potential future activities on NPS lands.

NATURAL RESOURCES

General

Livestock grazing allotments (if not voluntarily terminated by the lessees) would be managed using best management practices to minimize impacts on the natural resources of the park addition lands — including fossil-rich geologic strata and soils; vegetation and wildlife; streams, water quality, wetlands, and riparian areas; and federal and state listed species if present. Comprehensive rangeland condition assessments would be used to determine which areas are most susceptible to livestock impacts — such as compacting and eroding soils, trampling of rare plants, erosion of streambanks, and exposed fossils; spreading invasive plants; and overgrazing areas during drought conditions. To mitigate these impacts, livestock would be temporarily or permanently fenced out of certain areas, as needed. The duration and intensity of use by livestock would also be periodically adjusted, as needed, to lessen these adverse effects.

Public use of the park addition lands would be closely monitored to detect adverse impacts on natural resources — such as the loss or damage of petrified wood and other fossils, vegetation trampling, and disturbances to wildlife. Although most visitor opportunities would be nonmotorized, limited to designated areas, and/or guided by park staff, there is still a potential for inadvertent or deliberate visitor-related impacts. To mitigate these impacts, techniques such as educational programs, restricting certain visitor activities, and ranger patrols would be used.

Geologic Resources and Soils

Best management practices to prevent soil erosion would be used, such as the use of silt fences during the maintenance or removal of stock tanks. These techniques would mitigate potential impacts on water resources, including the degradation of adjacent wetlands.

The National Park Service would work with owners of mineral rights to avoid or minimize potential adverse effects on natural resources resulting from mining activities. Such measures could include assisting with the placement of mining operations to avoid fossil-rich geologic strata and advising on effective reclamation techniques after mining has occurred.

Paleontological Resources

Best management practices would be used during the collection of exposed fossils to ensure that they are not damaged during excavation. General mitigation described

above would also help avoid adverse impacts on paleontological resources.

NPS staff would design any future public access routes away from fossil-rich areas, which would help minimize these impacts. As part of this cautious approach, paleontological inventories would be necessary before appropriate public access routes are determined.

Water Resources

To prevent water pollution during cleanup efforts of existing dump sites, best management practices would be followed, such as techniques to contain hazardous materials. Mitigation described for many of the previous natural resource topics would also benefit water resources, such as best management practices during the maintenance or removal of stock tanks and efforts to control of livestock use.

Vegetation and Wildlife

Special attention would be devoted to preventing the spread of invasive plant species. Standard operating procedures could include ensuring that vehicles entering the park addition lands are free of mud or other seed-bearing material, certifying that all hay used for cattle feed is free of weeds, and using appropriate native plant species during restoration work. Also, see the general natural resource discussion above for other mitigative measures to minimize impacts associated with livestock and visitor use.

Federal and State Listed Species

The mitigative measures listed above for vegetation and wildlife and for general natural resources would also benefit federal and state listed species. Additional conservation measures would include the following actions.

- Surveys would be conducted for special status species before deciding to take any action that may cause harm. In consultation with the U.S. Fish and Wildlife Service and Arizona Game and Fish Department, appropriate measures would be taken to protect any sensitive species whether identified through surveys or presumed to occur.
- If breeding or nesting areas for special status species were observed in the park addition lands, these areas would be protected from disturbance.
- Management actions would occur in locations that avoid adverse effects on special status species. If avoidance was infeasible, appropriate conservation measures would be taken in consultation with the appropriate agencies.
- Restoration and monitoring plans would be developed as warranted to assist in the recovery of special status species. Plans would include methods for implementation, performance standards, monitoring criteria, and adaptive management techniques.
- Measures would be taken to reduce the adverse effects of invasive species on special status species.

CULTURAL RESOURCES

Actions outlined in the alternatives identified in this document are subject to the requirements identified in the NPS *Management Policies 2006* and Director's Order 28 and its accompanying "Cultural Resources Management Guideline."

Archeological Resources

If an archeological resource is in danger of being destroyed on NPS-owned or managed lands within the addition lands, park staff would stabilize the site and, if necessary, data would be recorded and the resource recovered in consultation as outlined above.

As appropriate, archeological surveys and/or monitoring would precede any ground disturbance. Known archeological resources would be avoided to the greatest extent possible during construction. If national register eligible or listed archeological resources could not be avoided, an appropriate data recovery plan would be developed in consultation with the Arizona state historic preservation officer and, if appropriate, any associated Indian tribes. If during construction previously unknown archeological resources were discovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and, if the resources cannot be preserved *in situ*, an appropriate mitigation strategy would be developed in consultation with the state historic preservation officer and, if appropriate, any associated Indian tribes.

If human remains are discovered, either because of park staff activities or through natural erosion, the park superintendent and other appropriate park staff would be notified. Measures would be instituted to protect the remains, and the superintendent would notify appropriate state and local officials, including tribes and the Arizona state historic preservation officer. Any artifacts found in association with the remains, such as funerary objects, sacred objects, and objects of cultural patrimony, would be left in place. If the remains were determined to be of American Indian origin, the superintendent would act according to the provisions of the Native American Graves Protection and Repatriation Act and its implementing regulations, current agreements with affiliated tribes, and the Archeological Resources Protection Act.

Adverse impacts on archeological sites would also be avoided by following the guidelines presented in the *Secretary of the Interior's Standards for Archeology and Historic Preservation*.

All proposed documentation/recordation and mitigative measures for archeological resources would be stipulated in a memorandum of agreement between Petrified Forest National Park, the Arizona state historic preservation office, and the appropriate tribes (and/or , as necessary, the Advisory Council on Historic Preservation).

Historic Structures

To appropriately preserve and protect national register listed or eligible historic structures, all stabilization, preservation and rehabilitation efforts would be undertaken in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995). Any materials removed during rehabilitation efforts would be evaluated to determine their value to the park's museum collections and/or for their comparative use in future preservation work at the sites.

To assist in future management decisions for landscapes and associated resources, both cultural and natural, cultural landscape inventories would be conducted to identify landscapes potentially eligible for listing in the national register.

The management of cultural landscapes would focus on preserving the landscape's physical attributes, biotic systems, and use when that use contributes to its historical significance.

The preservation and rehabilitation of cultural landscapes would be undertaken in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*.

THE ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The environmentally preferable alternative is the alternative that promotes the national environmental policy expressed in the National Environmental Policy Act (Sec. 101(b)). This includes alternatives that

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
(2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
(3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
(4) preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
(5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The no-action alternative is meant to represent how the park is currently managed as a mix of privately owned and state-owned ranchland with a small proportion of recently acquired NPS land. This alternative is required and provides a baseline against which to compare the effects of the action alternative. The no-action alternative only minimally meets the six criteria outlined above. Furthermore, it minimally meets the GMP amendment's purpose and need and minimally addresses the planning issues outlined in chapter 1.

Under the action alternative, the National Park Service would manage the addition lands cautiously while gathering as much information about them as possible during the next 15 to 20 years. By managing the addition in a cautious manner, by protecting natural and cultural resources and values, and by limiting new development until the addition lands are better understood, the action alternative meets criteria 1 through 5. The alternatives do not differ much with respect to criterion 6.

After considering the environmental consequences of the two management alternatives, the National Park Service has concluded that the action alternative is also the environmentally preferable alternative. This alternative best achieves the range of national environmental policy goals as stated in section 101 of the National Environmental Policy Act.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED EVALUATION

During the planning process, other management concepts were considered for the addition lands, including (a) a concept that focused on building stewardship and a park constituency through recreational opportunities, (b) a concept that emphasized research and science, and (c) a concept that would have maximized resource protection at the expense of other activities and visitor opportunities. The following provides a brief summary of each alternative concept.

Concept A would expand options for dispersed recreation use and visitor opportunities. This alternative would encourage first-hand experiences for visitors, such as camping, backpacking, hiking, horseback riding, and mountain biking. The park would focus on establishing and maintaining recreational facilities and other developments to support these opportunities.

Concept B would emphasize scientific study to increase knowledge and understanding of the park addition land's resources. This alternative would focus on educating visitors about research efforts and new discoveries to enhance public appreciation. The park would offer limited access and infrastructure to meet research program goals. Few new recreational opportunities for the public would be provided.

Concept C would be highly restrictive to ensure that park resources are preserved in the most pristine possible condition. There would be little to no tolerance for impacts, and few hands-on opportunities for visitors. The park would focus on stabilizing paleontological and archeological resources rather than collection for research purposes. Ecosystems would be restored.

Ultimately, the planning team decided to dismiss all of these concepts from detailed evaluation. The overarching reason is because the National Park Service has full management responsibility for only 12% of the addition lands, and it could be a decade or more before most of the addition lands are under NPS ownership or management. The National Park Service recognizes private property rights, laws governing state lands, and other valid existing rights (e.g., mineral rights) on the remaining 78% of the addition lands, making implementation of these alternative concepts technically infeasible for the foreseeable future.

Concept A, which focused on building stewardship and a park constituency through recreational opportunities, was also dismissed because so little is known about the park addition land's resources. The planning team wanted to avoid making ill-advised decisions, such as recommending new access or developments in an unsuitable area or rendering areas ineligible for wilderness before a required wilderness study is conducted. As such, this concept could have caused too great of an environmental impact on sensitive park resources. The planning team also wanted to avoid raising unrealistic public expectations about visitor use on the addition lands when it may be some time before the National Park Service owns enough land that it can offer a range of visitor opportunities.

Concept B, which emphasized research and science, was also dismissed because most actions under this alternative were a duplication of the action alternative's initial approach of conducting resource inventories, condition assessments, and other types of information gathering.

Concept C, which maximized resource protection at the expense of other activities and visitor opportunities, was also dismissed because it did not meet the park's purpose of providing opportunities for the public to

experience the park's resources. Although visitor opportunities would not happen immediately under the action alternative, they would be considered after a determination of which areas could sustain visitor use without resource damage.

TABLE 2. SUMMARY OF KEY DIFFERENCES AMONG ALTERNATIVES

	No-action Alternative	Action Alternative
Overview	Current management would be continued. Addition lands would remain a mix of private, state, and NPS ownership and management.	This alternative describes the NPS preferred management approach for addition lands that come into NPS management (or comanagement with the state) over time. Until private lands can be acquired by the National Park Service from willing sellers, the Park Service would consider additional strategies for conserving high-priority parcels and for providing appropriate public access. The National Park Service would manage the lands cautiously while gathering as much information about them as possible. This alternative best meets the purpose and need for the plan amendment.
Desired Future Conditions Related to the Addition Lands	Not applicable.	The National Park Service builds and maintains excellent relationships with private inholders and with neighboring landowners and land managers. The National Park Service understands the extent, nature, and condition of addition lands resources, especially paleontological, archeological, and biological resources. Addition lands resources, especially paleon-tological and archeological resources, are preserved and protected. Park visitors understand why the addition lands are so special that the authorized park boundary was expanded to include them. Park visitors eventually have first-hand opportunities to see and experience the addition lands. The National Park Service eventually acquires management jurisdiction for all addition lands. The addition lands' wilderness character and wilderness eligibility is retained until a future wilderness study determines how much land, if any, should be proposed for wilderness designation.
Management Zones for the Addition Lands	Addition lands are not zoned.	Two management zones are recommended for the addition lands — the **transportation corridor zone** (borrowed from the 2004 *General Management Plan Revision*) and the **inventory and interim protection zone** (new).

	No-action Alternative	Action Alternative
Natural Resource Management	The National Park Service would continue to survey the NPS-owned addition lands (12%) for paleontological resources and collect important fossils that are threatened. Assuming continued permission, NPS staff would continue to do the same on the 29% of the state-owned addition lands, as staffing and access constraints permit. There would be no systematic paleontological surveys on addition lands that are in private ownership (59%), unless authorized by landowners. Legal mining and removal of petrified wood would likely continue on some private lands. Natural plant and animal communities, including nonnative invasive species, would continue to exist in their current state on the addition lands. Some private landowners would continue to manage their lands with the conservation of natural resources in mind; other privately owned addition lands would not necessarily be managed for that purpose.	Once the National Park Service has management jurisdiction of addition lands, the agency would conduct comprehensive baseline inventories for paleontological resources, such as petrified wood and other fossils. Important fossils that are threatened by erosion and exposure would also be collected for preservation and study. The National Park Service would also conduct comprehensive baseline inventories for other natural resources, such as vegetation, wildlife, streams, springs and seeps, and invasive exotic species. Condition assessments for specific resources (vegetation, riparian corridors, etc.) would also be conducted. High-priority trouble spots that require immediate treatment and restoration, such as concentrations of invasive exotic species and severely disturbed sites, would be identified and addressed. Once they are no longer needed, fences that inhibit natural wildlife movements would be removed.
Cultural Resource Management	There would be no cultural resources inventories and no cultural resources management program for the addition lands — except for 12% of NPS-owned lands. Even though some private landowners do their best to conserve archeological resources and historic structures on their land, potential historic structures and many archeological sites on state, private, and federal lands would likely continue to deteriorate, be disturbed, or be lost because of trampling, vandalism, and natural forces.	The National Park Service would conduct baseline surveys and condition assessments for archeological sites cultural landscapes on the addition lands once they are owned or managed by the National Park Service. The agency would also inventory potential historic structures and cultural landscapes and evaluate structures, sites, and landscapes for eligibility to be listed in the national register. The agency would also work to identify ethnographic resources and allow tribal access to sites of traditional, religious, subsistence, or other significance according to NPS policies. Potential historic structures would be stabilized until they could be evaluated for national register eligibility and decisions could be made about their long-term treatment.
Research	A very limited amount of academic research would likely take place on private lands. Some limited geologic, paleontological, and archeological research would also be conducted on the NPS- and state-owned lands.	The National Park would direct, conduct, and encourage research that expands park and public knowledge and understanding about park resources, with special emphasis on archeology and paleontology. Research that contributes to management decision-making would be promoted.

Table 2. Summary of Key Differences among Alternatives

	No-action Alternative	Action Alternative
Facilities and Development	Development would remain limited to existing infrastructure associated with cattle ranching. Such facilities would continue to be maintained at the discretion of landowners.	The National Park Service would thoroughly inventory existing infrastructure (e.g., roads, buildings, fences, stock tanks) once management jurisdiction of the addition lands is acquired from willing sellers. Longer term infrastructure and development decisions would be made in a future comprehensive general management plan / wilderness study that addresses management of the pre-2004 park and the addition lands holistically. Pending completion of such a future plan, any new facilities developed by the Park Service would be minimal (e.g., restrooms, small patrol cabins, or entrance kiosks) and would be carefully sited to avoid rendering areas ineligible for wilderness consideration. Any new hiking trails would be carefully sited and use existing trails and ranch roads to the extent possible. Similarly, vehicular routes for administrative use would be unimproved and would use ranch roads as much as possible.
Administrative Access	NPS staff would be able to access NPS lands where such access does not require crossing private or state land. NPS access to state lands would continue as permitted under NPS-state agreements.	The National Park Service would evaluate existing and potential routes to better understand opportunities for administrative access, and it would use such routes where resource, safety, cost, and legal considerations allow. Pending completion of a future wilderness study, administrative routes would remain unimproved and limited to those necessary for critical management activities.
Public Use and Access	There would continue to be no general public access on the addition lands. Use and access for activities such as hunting on private lands or research would occur only with specific permission from landowners.	Following acquisition of management jurisdiction, the National Park Service would evaluate existing routes and resource protection considerations to better understand opportunities for visitor access. Nonmotorized, nonmechanized, public access would be allowed on such routes where resource, safety, cost, and legal considerations allow. Pending completion of a future comprehensive general management plan / wilderness study, routes for public access would remain unimproved to avoid rendering areas ineligible for wilderness consideration.
Park Visitor Opportunities	There would continue to be a lack of access and on-site opportunities for park visitors on the addition lands. Park visitors could still see the addition lands from various designated and informal viewpoints.	Initially, the National Park Service would identify areas that can sustain visitor use without resource damage. Visitor use would then be allowed and encouraged as appropriate given access, resource, and safety considerations, and without precluding wilderness eligibility. Recreational opportunities might include extended hiking and backcountry camping opportunities in designated areas and interpretive and educational programs.

	No-action Alternative	Action Alternative
Park Visitor Education and Interpretation	Limited educational and interpretive information about the addition lands would continue to be provided to park visitors.	Visitor education and interpretive opportunities would be provided for visitors to learn about the addition lands. These would include self-guided and guided on-site opportunities and off-site opportunities.
Special and Other Uses (Grazing, Mining, etc.)	Cattle ranching on the addition lands would continue. Petrified wood and basalt cinder mining would likely continue on privately owned addition lands in a limited number of locations. Some private development of residences or ranchettes would also probably slowly occur on private lands. Hunting would likely continue on a limited basis on private lands (permission of the landowner is required) and state lands (permit is required).	In accordance with valid existing rights and applicable laws, the National Park Service would allow continued livestock grazing in a manner that minimizes impacts on park resource and values. The agency would accept voluntary termination of grazing permits or leases, per the Petrified Forest National Park Expansion Act of 2004. Similarly, the agency would work with owners of mineral rights to avoid or mitigate impacts on park resources resulting from mining-related activities. If the agency determines that resource impacts cannot be avoided or mitigated, authorization would be sought to acquire mineral rights. Hunting would continue to be prohibited on NPS-owned lands. In general, hazardous materials would be identified and removed before NPS acquisition of land parcels.
Future Plans and Studies	No new future plans or studies would be proposed.	Many inventories, studies, assessments, mapping efforts, and future plans would be conducted (see description of the action alternative in this chapter).
Partnerships	NPS staff would continue to work on a limited basis with the state and with private landowners to address goals and issues of mutual interest related to the addition lands.	NPS staff would collaborate with park neighbors and the state to achieve common goals and to protect park resources and values, including viewsheds, night skies, and soundscapes.
Commercial Services	No commercial services would be provided within the addition lands.	No commercial services would be provided within the addition lands during the life of this GMP amendment.
Park Boundary Adjustments	No boundary adjustments would be proposed under the no-action alternative.	No boundary adjustments would be proposed under the action alternative; this GMP amendment is focused exclusively on management of lands within the 2004 boundary expansion area.

Table 2. Summary of Key Differences among Alternatives

	No-action Alternative	Action Alternative
Staffing and Costs	The park would continue to be staffed at the 2008 level: 53 full-time-equivalent (FTE) employees. Volunteers and partnerships would continue to be key contributors to NPS operations. The cost of this alternative is estimated at $592,200. Annual operating costs would be $3.54 million.	The park would be staffed at 62 full-time-equivalent (FTE) staff members. Volunteers and partnerships would continue to be key contributors to NPS operations. The cost of the action alternative is estimated at $6.6 million for resource inventories, condition assessments, mapping efforts, etc. for some 125,000 acres (essentially the entire addition lands area). Annual operating costs for the action alternative would be $4.44 million.

TABLE 3. COST ESTIMATES FOR IMPLEMENTING THE ALTERNATIVES
(all cost estimates are in 2009 dollars)

	No-action Alternative	Action Alternative
Annual Operating Costs (ONPS)[1]	**$3,543,000**	**$4,438,000**
Staffing - FTE[2]	**53**	**62**
Total One-Time Costs	**$592,200**	**$6,610,000**
Facility Costs[3]	0	0
Nonfacility Costs[4]	$592,200	$6,610,000

(1) Annual operating costs are the total costs per year for maintenance and operations associated with each alternative, including utilities, supplies, staff salaries and benefits, leasing, and other materials. Cost and staffing estimates assume that the alternative is fully implemented as described in the narrative.

(2) Total full-time equivalent (FTE) employees are the number of persons/year of staff required to maintain the assets of the park at a good level, provide acceptable visitor services, protect resources, and generally support the park's operations. The number of FTE employees indicates ONPS-funded NPS staff only, not volunteer positions or positions funded by partners. FTE employee salaries and benefits are included in the annual operating costs.

(3) One-time facility costs typically include those for the design, construction, rehabilitation, or adaptive reuse of visitor centers, roads, parking areas, administrative facilities, educational facilities, maintenance facilities, etc. For this addition lands GMP amendment, no facilities are proposed for either alternative.

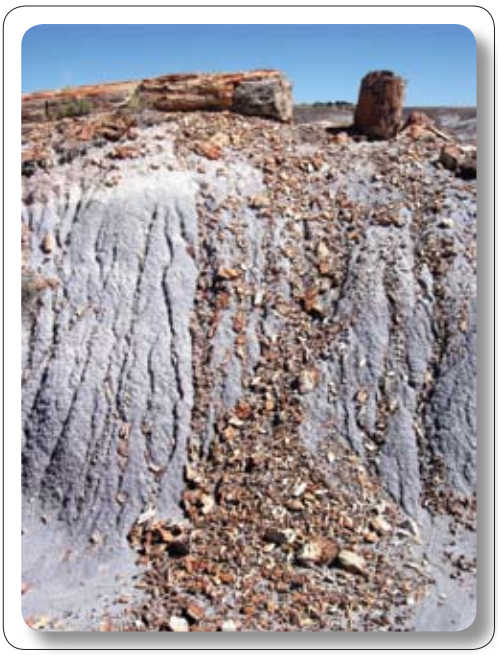
(4) One-time nonfacility costs include actions for preservation of cultural or natural resources not related to facilities, development of visitor use tools not related to facilities, and other park management activities that would require substantial funding above the park annual operating costs. Examples for this addition lands GMP amendment include resource inventories and condition assessments, resource mapping efforts, and development of education and interpretive programs/materials. For the no-action alternative, this includes a limited number of resource inventories for lands that were within NPS management jurisdiction as of December 2008.

TABLE 4. SUMMARY OF KEY IMPACTS OF THE ALTERNATIVES

Impact Topic	No-action Alternative	Action Alternative
Geological Resources and Soils	The no-action alternative would result in long-term, moderate, adverse impacts on geologic resources and soils on the park addition lands.	The action alternative would result in short- and long-term, minor, to moderate, beneficial impacts on geologic resources and soils on the park addition lands.
Paleontological Resources, including Petrified Wood	The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, minor, beneficial impacts on the paleontological resources of the park addition lands.	The action alternative would result in long-term, moderate, beneficial effects and long-term, minor, adverse effects on the paleontological resources of the park addition lands.
Water Resources	The no-action alternative would result in long-term, minor to moderate, adverse impacts on streams, water quality, wetlands, floodplains, and riparian areas. Long-term minor to moderate beneficial effects and some localized major adverse impacts could also occur.	The action alternative would result in long-term, moderate, beneficial effects.
Vegetation and Wildlife	The no-action alternative would continue to result in long-term, moderate, adverse impacts and long-term, minor to moderate, beneficial effects on vegetation and wildlife.	The action alternative would result in long-term, negligible to moderate, beneficial effects.
Federal and State Listed Species	The no-action alternative would have long-term, minor to moderate, adverse impacts and long-term, minor, beneficial effects on federal and state listed species if they are present on the park addition lands.	The action alternative could result in long-term, minor to moderate, beneficial effects, and long-term, minor, adverse effects on federal and state listed species if identified in the park addition lands.
Archeological Resources	Long-term impacts related to livestock grazing, mining, vandalism, pothunting, and natural erosion would continue to be site specific and adverse, and would range from minor to major.	Closer monitoring, informed management, directed use based on inventory and documentation of archeological sites and likely reduced mining and grazing would provide long-term, moderate, beneficial impacts on archeological resources.
Historic Structures	Impacts related to historic structures and districts because of existing uses would continue to be long term, site specific, minor to major, and adverse and long term, minor, and beneficial.	The action alternative would result in long-term, minor to moderate, beneficial effects on the national register-eligible historic structures in the park addition lands.
Visitor Use and Experience	The no-action alternative would result in primarily negligible to minor effects on visitor experience because of potential changes in land use.	The action alternative would result in long-term, beneficial, moderate effects on visitor use and experience.
Park Operations	The no-action alternative's effect on park operations would continue to be minor and adverse.	The action alternative's effect on park operations would be long term, moderate, and beneficial and adverse.
Socioeconomic Environment	The no-action alternative would have negligible, long-term, beneficial effects on the socioeconomic environment as a result of modest one-time federal spending.	The action alternative would have minor, long-term, beneficial effects on the socioeconomic environment as a result of an increase in park jobs and spending as well as an increase in visitor spending.

3

The Affected Environment



INTRODUCTION

IN GENERAL

This chapter describes what is known about the environment of Petrified Forest National Park's addition lands. The focus is on key known park addition resources, visitor experiences, park operations, and the socio-economic environment that could be affected by the alternatives if they were implemented. The chapter does not provide an exhaustive description of these resources; rather enough detail is provided to understand the effects of implementing the alternatives. These topics were selected on the basis of federal law, regulations, executive orders, NPS expertise, and concerns expressed by other agencies or members of the public during project scoping. The description of the existing environment establishes the baseline for the analysis in "Chapter 4: Environmental Consequences."

During internal scoping, the park's interdisciplinary team conducted a preliminary analysis of resources to determine the context, duration, and intensity of effects that the proposal may have on the resources in the addition lands. If the magnitude of effects was determined to be at the negligible or minor level, there is no potential for substantial impact and further impact analysis is unnecessary; therefore the resource is dismissed as an impact topic. If however, during internal scoping and further investigation, resource effects are greater than a minor level of intensity, then the analysis of that resource as an impact topic is carried forward.

The first section in this chapter discusses impact topics that are analyzed in detail in this *General Management Plan Amendment / Environmental Assessment* (see also table 5). The next section describes impact topics that are not analyzed

TABLE 5. IMPACT TOPICS

Impact Topics Analyzed in this Plan	Impact Topics Eliminated from Detailed Analysis in this Plan
Alternatives in this plan could affect these resources or topics	These resources or topics are important, but alternatives in this plan would have only positive impacts on them, and/or any adverse impacts would be negligible to minor.
Geologic Resources and Soils	Air Quality
Paleontological Resources (including petrified wood and other fossils)	Wild and Scenic Rivers
Water Resources (including water quality, wetlands, floodplains, and streams)	Prime or Unique Farmlands
Vegetation and Wildlife	Ecologically Critical Areas
Federal and State Listed Species (including threatened and endangered species)	Carbon Footprint
Archeological Resources	Cultural Landscapes
Historic Structures	Ethnographic Resources
Visitor Use and Experience (including viewsheds, night skies, and soundscapes)	Museum Collections
Park Operations	American Indian Trust Resources
Socioeconomic Environment	Environmental Justice
	Energy Requirements and Conservation Potential

in detail (see table 5) and explains the rationale for this decision Information about each resource topic corresponds to the level and type of impacts being analyzed. Because comprehensive resource inventories have not been completed for the addition lands, these descriptions are based on what limited information has been gathered to date. Knowledge about natural and cultural resources in the pre-2004 park is also used to infer what resources might exist in the addition lands.

CLIMATE CHANGE

As stated earlier, an important aspect of this chapter is a description of the resource conditions of the park addition lands in order to understand the effects of the alternatives. As relevant to each resource topic, this chapter includes a description of past, present, and future trends in resource conditions. Because climate change is an important factor that has the potential to influence future trends in resource conditions, it is included as part of the description of the affected environment of the park addition lands.

According to the Environmental Protection Agency (1998), by the year 2100, average temperatures in Arizona are projected to increase by 3-4 degrees Fahrenheit in spring and fall and by 5 degrees in winter and summer. As a result, the climate of Arizona will likely become more variable, such as an increase the frequency and intensity of extreme weather (e.g., storms, droughts, floods, hot or cold spells) and other associated natural events (e.g., wildfires and pest outbreaks). Precipitation is also expected to become more variable, and the Environmental Protection Agency estimates a slight decrease in summer precipitation and an increase in fall, winter, and spring precipitation.

Other climate models predict different results, especially regarding regional precipitation patterns and trends. In fact, there is broad consensus among climate models that the Colorado Plateau will become more arid with periodic droughts that are more severe and possibly longer (Seager et al. 2007).

The potential influences of these changes are described under the following resource topics of this chapter, which are considered by the planning team to be at the greatest risk from the impacts of climate change: paleontological resources, water resources, vegetation and wildlife, archeological resources, historic structures, and visitor experience.

CULTURAL RESOURCES

Background

Like the lands in the park before the designation of the addition lands, cultural resources in the addition lands are considered nationally significant. It is for this reason that these lands were incorporated into the existing Petrified Forest National Park.

As noted in the 1993 *General Management Plan* and 2004 *General Management Plan Revision*, prehistoric resources are extensive in Petrified Forest National Park. In the pre-2004 park, more than 700 sites have been recorded representing the Paleoindian, Archaic, Basketmaker, Puebloan, and Navajo cultures. It is likely that the addition lands will yield similar numbers and types of sites. Certain inferences from existing sites can be made about the addition lands related to possible Paleoindian, Archaic, Basketmaker, Puebloan, Navajo, and historic period sites likely to be located in the addition lands.

In Arizona, archeologists and historians define the period of time between about 12,000 years ago and the first contact with people of European, Asian, or African descent with the region as the prehistoric era and the period after contact as the historic era.

Historic Property Definitions

Historic properties, under 36 CFR Part 800, are defined as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the [National Register of Historic Places] . . . ." The phrase "eligible for inclusion in the National Register of Historic Places" includes both the properties formally determined as such by the National Park Service on behalf of the secretary of the Department of the Interior and all other properties that meet NRHP listing criteria.

NPS guidelines regarding the definition of buildings, sites, structures, objects, districts, and landscapes are listed below.

- A building is created principally to shelter any form of human activity such as a barn, house, church, or hotel.
- A site is the location of a significant event; a prehistoric or historic occupation or activity; or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value, regardless of the value of the existing structure.
- A structure is a functional construction usually made for purposes other than creating human shelter such as tunnels, bridges, dams, and fire towers.
- An object is primarily artistic in nature or is relatively small in scale and simply constructed. Although an object may be movable by nature or design, it is associated with a specific setting or environment. Examples include sculpture, boundary markers, and statues.
- A district possesses a significant concentration, link, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development, such as a college campus, central business district, large fort, or rural village.
- A landscape is associated with events, persons, design styles, or ways of life that are significant in American history, landscape architecture, archeology, engineering, or culture.

IMPACT TOPICS INCLUDED FOR DETAILED ANALYSIS

GEOLOGIC RESOURCES AND SOILS

Geologic Resources

The colorfully sculpted badlands found throughout the park addition lands are the present-day exposures of the Chinle Formation. This formation resulted from the rapid deposition of river and lake sediments beginning around 205 million years ago during the Late Triassic period of Earth's history. Before the park's expansion, only 6 miles of the 22-mile-long escarpment were in the park. The addition lands encompass an additional 12 miles, leaving only the easternmost 4 miles of the escarpment outside the park boundary (see Comparison of Proposed versus Actual Addition Lands map in chapter 1). The research and interpretive values of the portions of the escarpment in the addition lands are believed to surpass the portion inside the pre-2004 park boundary.

The Chinle Formation is composed of five geologic layers or strata, including (from oldest to youngest), the Mesa Redondo, Blue Mesa, Sonsela, Petrified Forest, and the Owl Rock members (MNA 2006). The extent to which these members are exposed across the park addition lands has not been fully determined. Although it would require an extensive mapping effort it is believed the Mesa Redondo Member is best exposed in the addition lands. A better understanding would play an important role in further deciphering evidence of the Late Triassic ecosystem.

The western portion of the Chinle escarpment is similar to Blue Mesa in the pre-2004 park, but on a grander scale. Huge broken sandstone blocks and rimrock badlands are like giant stair steps, rising more than 500 feet above the Puerco River. Twin Buttes, both rising above 5,670 feet in elevation, stand detached from the escarpment, surrounded by a broad expanse of short-grass prairie. Ramsey Slide, near Twin Buttes, is an eroded section of the escarpment where sandstone layers have eroded back to expose the Chinle Formation. East of Ramsey Slide, the escarpment is steeper and higher, forming a ragged wall capped by sandstone that extends east for 3 miles to the western edge of the Jasper Forest valley within the pre-2004 park.

The eastern portion of the Chinle escarpment, where lateral exposures of the formation are more continuous, is one of the best representations of this geologic sequence in the world. This portion of the escarpment is less visually striking than the western portion because of its more gradual rise in elevation. However, the steep slopes of Sorrel Horse Mesa, a disjunct remnant that is about a mile north of the escarpment, commands the view for miles. East of this mesa, the escarpment begins to arc gently to the northeast before it reaches the eastern boundary of the addition lands. Here the escarpment appears more like a vast eroded basin, deeply incised by steep gullies that have no vegetation.

The park addition lands also include the western rim of the Painted Desert, the Devils Playground, and the Rainbow Forest Badlands, all of which include fossil-bearing strata. The rimrock badlands, buttes, and mesas found within these and other areas of the addition lands combine to form a dramatic landscape that rises from the Puerco River to an elevation of more than 5,800 feet. Other noteworthy geologic features of the park addition lands include Billings Gap, Black Knoll, and Saddle Horse Draw, all of which add to the unique character of this vast, high-desert landscape.

In addition to these geologic resources, the park addition lands contain various subsurface minerals, including uranium, cinder (basalt), and potash (an impure form of potassium carbonate that is typically used in fertilizers), as well as oil, natural gas, and helium. Of these, potash is considered to be the most economically viable. The potash

deposit in and around the park lies mostly 1,000–1,500 feet below the surface, which makes it feasible for conventional mechanized underground mining operations. The Thickness of Potash Deposition map illustrates the thickness and extent of this potash deposit (Arizona Geological Society 2008).

The state has issued permits for exploratory potash wells on state lands outside of the park; however, there are no active leases on federal or state-owned portions of the park addition lands, nor is the state or federal government planning to offer such leases (NPS 2008). Nevertheless, private lands in the park addition lands could still be developed for potash mining or other forms of mineral extraction — even petrified wood. Petrified wood is considered to be a mineral (rather than a fossil) by the state of Arizona and therefore it can also legally be collected on private lands by landowners or others with landowners' permission. More information about this issue is in the "Paleontological Resources" section of this chapter.

The potential for mining within the park addition lands is further complicated by the large number of subsurface mineral owners. See the Subsurface Mineral Ownership map for the number of subsurface owners per square-mile section of private land. The map illustrates that most private parcels have five or more subsurface mineral owners, and many have seven or more. (NPS 2007a)

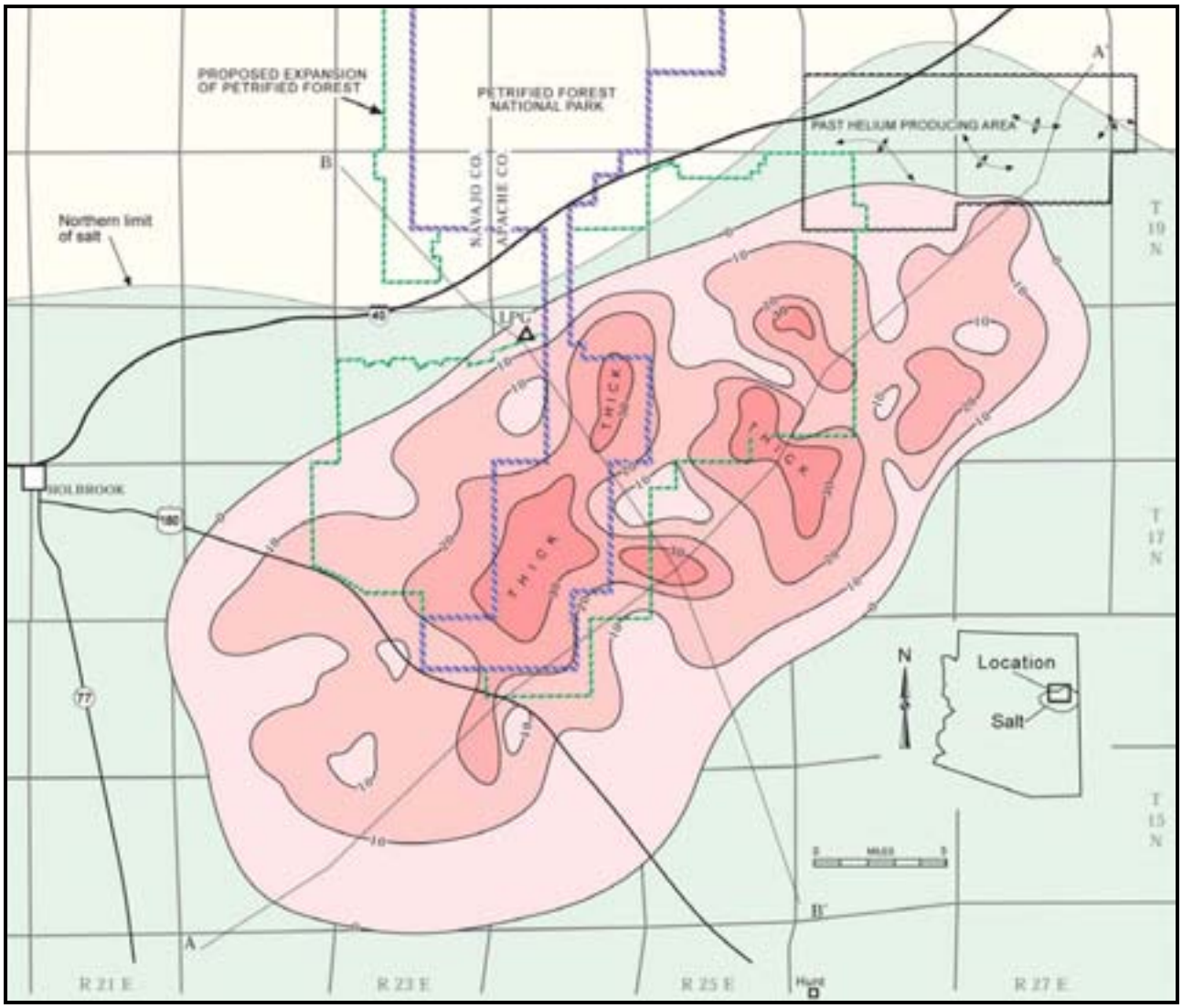
More information about past, present, and potential future mineral uses can be found in the geologic resources section of "Chapter 4: Environmental Consequences."

Soils

Soils that have been identified in the pre-2004 park boundary are also likely found within the park addition lands. These soils are composed primarily of silts, clays, and sands derived from erosion of the Chinle Formation. The most fertile soils are generally found in the short-grass prairies between the mesas and badlands, as well as on many of the mesa tops. These soils are composed of alluvial and wind-borne sands, making the soils quite permeable. The badland soils are composed of material from shales and have low permeability and high salt content. These clayey soils are particularly inhospitable to vegetation because water in these soils is held at a tension that is too high for plant roots to overcome, making water effectively unavailable to them. As a result, in this arid environment, the presence of clayey soils significantly limits the potential for the development of organic soils and vegetation.

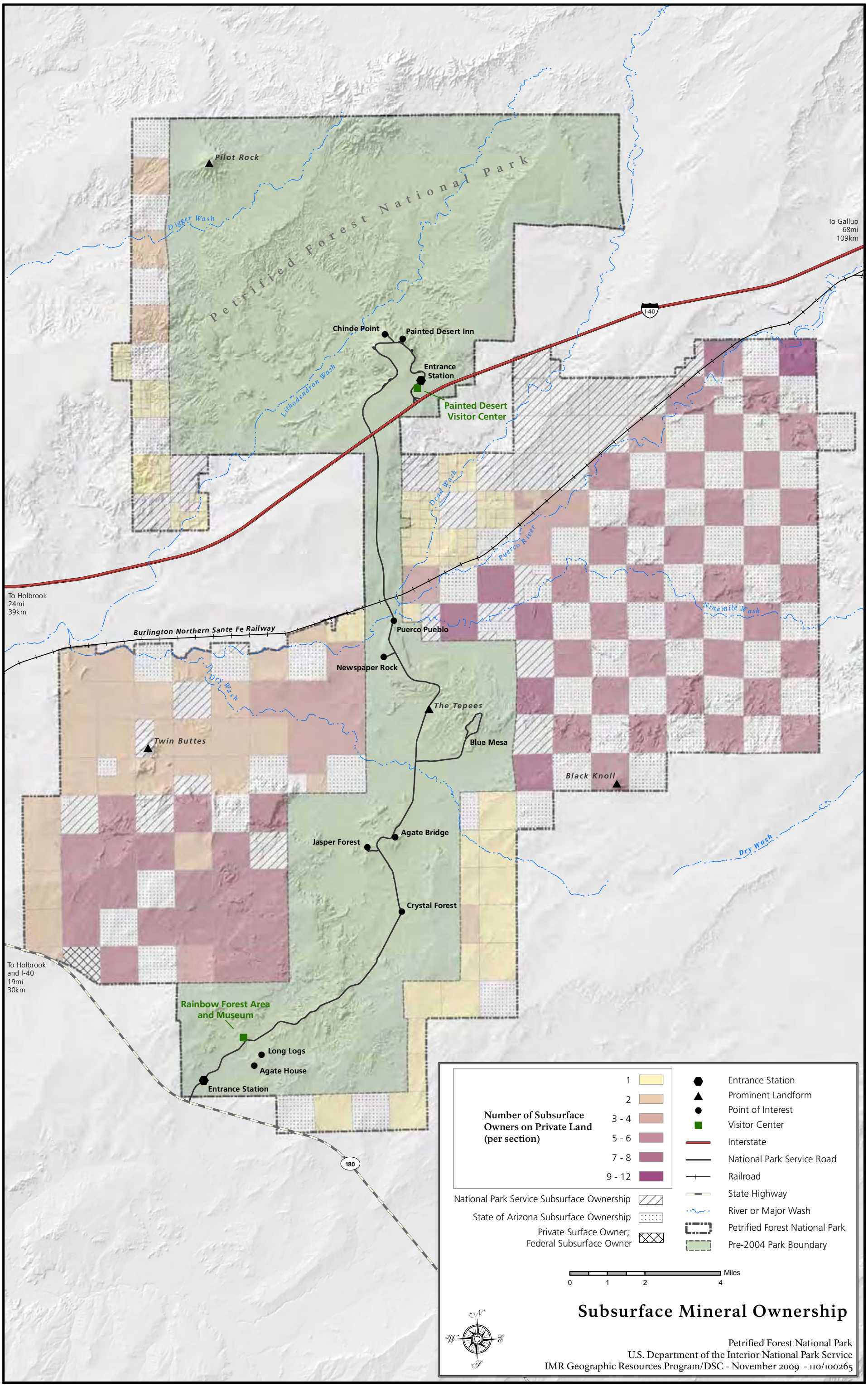
Park soils are generally characterized by four soil associations: Moenkopie-Sandstone, Tours-Jocity, Badland-Claysprings, and Clovis-Palma-Hubert. The Moenkopie-Sandstone association is characterized by well-drained, shallow and very shallow, nearly level to moderately sloping loamy sands formed in material eroded from sandstone and sandstone rock outcrops. The Tours-Jocity association consists of well-drained, deep, nearly level to gently sloping clay loams and sandy clay loams formed in alluvium (stream sediments). The Badland-Claysprings association is characterized by barren, eroded land and well-drained, undulating clays formed in material eroded from clayey shales. Finally, the Clovis-Palma-Hubert association consists of well-drained, deep, nearly level to undulating loamy sands and gravelly loams formed in eolian (wind-blown) sands and alluvium. More information on soils can be found in the park's *General Management Plan Revision* (NPS 2004).

In addition to these recognized soil associations, biological soil crusts (cryptobiotic soils) are also likely to be present in the addition lands. In arid regions where vegetative cover is generally sparse, open spaces may be covered by these highly specialized communities of cyanobacteria, mosses, and lichens. Biological soil crusts create a surface crust of soil particles bound together by organic materials that provide soil stability and resistance to wind and water erosion. Biological soil crusts



Source: Arizona Geological Society 2008.

Thickness of Potash Deposition



Subsurface Mineral Ownership

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also have an effect on plant germination and growth, appearing to enhance the ability of certain plants to survive in arid environments. (NPS 2004)

PALEONTOLOGICAL RESOURCES (INCLUDING PETRIFIED WOOD AND OTHER FOSSILS)

The park addition lands include a substantial portion of the fossil-bearing Chinle Formation, which formed between 205 and 220 million years ago during the Late Triassic period of Earth's history. The Chinle Formation gives clues on the depositional system (e.g., rivers, lakes, and swamps), climate, and position on the globe, as well as being full of plant and animal fossils. The formation details and tracks 15 million years of ecosystem evolution.

Although comprehensive inventories have not been completed on the addition lands, initial investigations have identified a number of sites that contain fossils. These include high concentrations of petrified wood, as well as vertebrate and invertebrate animals. Noteworthy sites include large deposits of petrified freshwater clamshells, huge petrified logs, and fossilized bones of phytosaurs — large, crocodile-like animals that were dominant predators during the Late Triassic.

There is also a high potential for discovering fossilized remains of early dinosaurs, amphibians, insects, fish, and other plants and animals. Based on research work within the pre-2004 park, a variety of fossils are expected to occur in the park addition lands. Plant fossils include leaves, stems, seeds, spores, and pollen from a number of plant species, including lycopods, tree ferns, cycads, and horsetails. Animal fossils include herbivorous aetosaurs, large carnivorous rauisuchians, and giant, flat-headed amphibians called metoposaurs. Aquatic invertebrates include crayfish, snails, clams, and conchostracan (clam-shrimp). The potential is also high for finding fossilized insects, such as beetles. Fish species, such as freshwater sharks, are also present. A systematic search of the addition lands could also lead to the discovery of new Late Triassic species, allowing scientists to more accurately interpret this diverse prehistoric ecosystem.

Sedimentologists, geologists, and paleontologists who have visited the park addition lands agree that the more continuous geologic exposures and fossil-bearing strata on these lands are possibly superior to those protected in the pre-2004 park. Research in these areas promises to increase understanding of Late Triassic flora and fauna and to allow for the academic reconstruction of the drainage networks (e.g., meandering rivers, streams, lakes, and swamps) that existed here during the Late Triassic period. This would result in a better understanding of this prehistoric ecosystem, changing climatic conditions, and even plate tectonics. (NPS 1993)

Ongoing erosion from wind and rain threaten these paleontological resources once they are exposed. This is especially true of fossilized bones, which are extremely fragile and very susceptible to erosion processes. It is known that many Late Triassic fossils have been lost on the park addition lands because of natural weathering. This phenomenon will likely be exacerbated by climate change due to projected increases in the frequency and intensity of storms in Arizona, which can increase erosion and weathering processes. One exception to this is agatized petrified wood that consists almost entirely of silica, which is actually more resistant to erosion than even the surrounding rock. Once exposed to the elements, collection is the only major threat to agatized petrified wood.

Petrified wood is not evenly distributed across the park's addition lands. Deposits vary in size and concentrations — from small fragments weathered out of the badlands to clusters of huge, petrified logs. Because petrified wood is considered to be a mineral (rather than a fossil) by the state of Arizona, it can still legally be collected on private lands in the park addition lands with the permission of the landowner. However, because many of the more

sizable logs have already been removed from the surface, more intrusive techniques to locate them underground could be used. Such techniques could include use of a powerful bulldozer with a ripper hook to crisscross an area in hopes of snagging a large petrified wood log. Once located, an excavator or back-hoe would then dig it out — resulting in extensive surface disturbance (NPS 2008). More information about petrified wood collection can be found in the paleontological resources discussion of "Chapter 4: Environmental Consequences."

WATER RESOURCES (INCLUDING WATER QUALITY, WETLANDS, FLOODPLAINS, AND STREAMS)

The park addition lands are in the Lower Puerco River, Leroux Wash, and Upper Colorado River watersheds, all of which are tributaries of the Little Colorado River. Most of the park addition lands are drained by the Puerco River, and its many tributaries, including Nine Mile Wash, Dead Wash, Dry Wash, and Lithodendron Wash. The northwestern portion of the addition lands is drained by Digger Wash, which eventually flows into Leroux Wash. The southern portion of the addition lands is drained by several small washes, which drain into the Upper Little Colorado River. (NPS 2003)

The park addition lands substantially increased the number of miles of rivers and washes that are included in the park. Table 6 below shows this increase in mileage. The Land Cover Types and Hydrology map shows their drainage pattern.

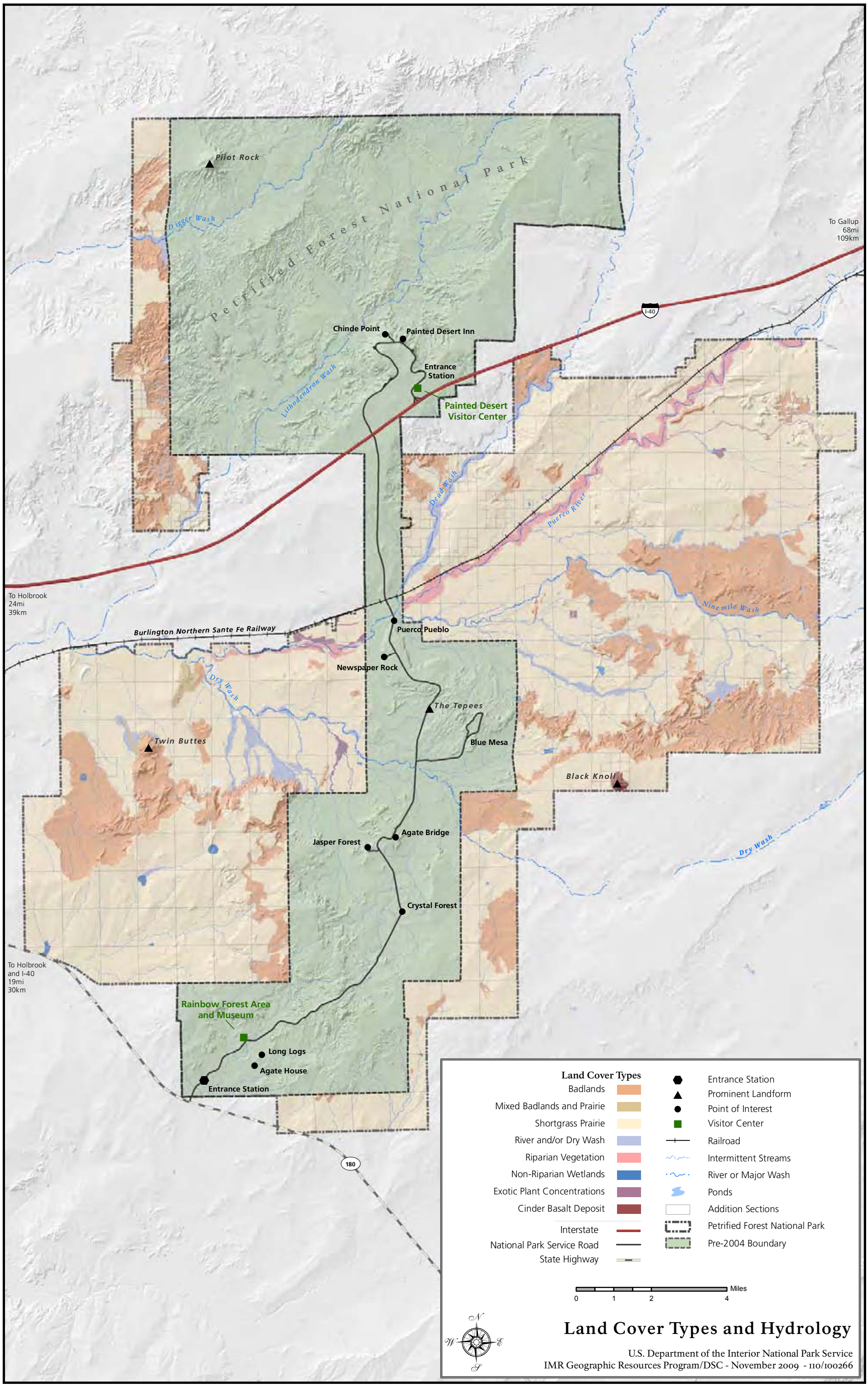
These rivers and washes are ephemeral in nature and only provide surface flow in response to rain and snow melt in the spring and flash-flooding during the summer monsoon rains. Surface water is also available seasonally in small pools, springs, and seeps. Surface water is found intermittently in a number of man-made, earthen stock tanks distributed across the addition lands. The Known Existing Infrastructure map shows the distribution of stock tanks within the area.

Although surface water quality information is limited, monitoring conducted by the Arizona Department of Health Services in 1985 indicated that the Puerco River at the park road bridge exceeded recommended drinking water and acute freshwater standards for arsenic, copper, lead, and zinc. It also exceeded drinking water standards for uranium and radium 226. These pollutants can impair the natural function of aquatic and terrestrial ecosystems and diminish their value for visitor use and enjoyment. However, a shortage of monitoring data exists to understand current water quality conditions and trends in the park addition lands. (NPS 2003)

Although it is difficult to assess the extent of these pollutants, possible sources include erosion, mineral extraction, wastewater discharges from upstream municipal sewage treatment facilities, stormwater runoff, livestock use, and atmospheric deposition. Potential sources of radioactive material in the Puerco River Basin include natural erosion of uranium bearing rock, waste products from uranium mine dewatering processes, and the one-time release of uranium into the Puerco River

TABLE 6. RIVER AND WASH MILEAGE

River/Washes	Number of Miles		
	Pre-2004 Park	Park Addition Lands	Total
Puerco River	1.7	25.4	27.1
Nine Mile Wash	0.3	14.3	14.6
Digger Wash	7.1	1.2	8.3
Lithodendron Wash	15.2	1.3	16.5
Dead Wash	1.2	7.2	8.4
Dry Wash	3.8	9.7	13.5
Total	**29.3**	**59.1**	**88.4**



Land Cover Types and Hydrology

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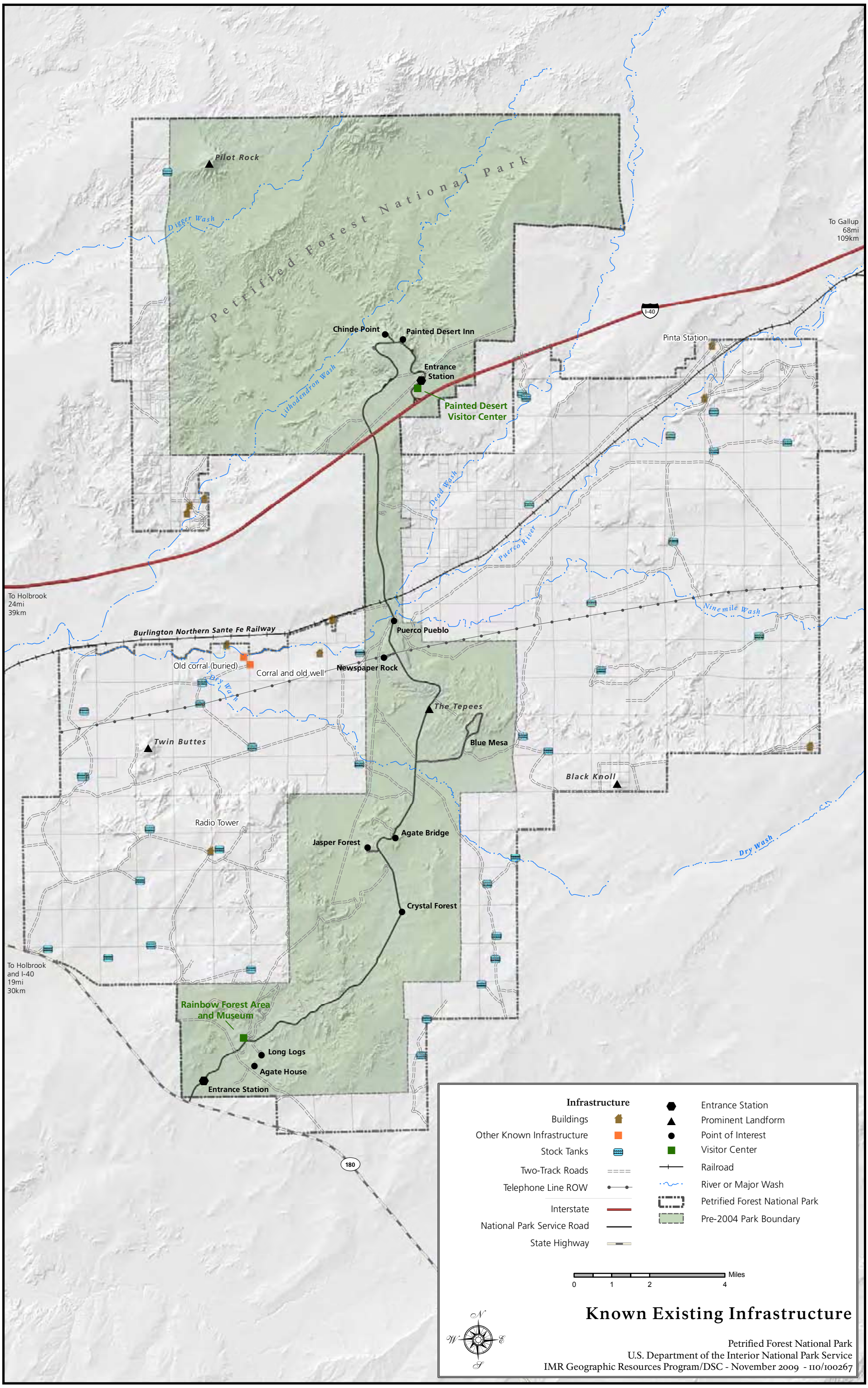

Known Existing Infrastructure

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from the collapse of a tailing pond retention dam in 1979 at the Church Rock Uranium Mill, located east of Gallup, New Mexico. This catastrophic release of 94 million gallons of uranium wastewater 30 years ago may still pose a threat to park resources. (NPS 2003)

The park addition lands also overlay two groundwater aquifers — the Puerco River Alluvial Aquifer and the Coconino Regional Aquifer, also known as the "C Aquifer." The Puerco River Alluvial Aquifer underlies the river and is recharged when the river is flowing. The C Aquifer is much deeper, underlying much of northeastern Arizona and northwestern New Mexico. In Arizona, the right to use groundwater is tied to property, and there are a number of smaller wells both within and outside the park that tap these aquifers. The extensive withdrawal of groundwater by two major power generating stations in Joseph City and St. Johns is a concern to the long-term supply of water from the C Aquifer to meet the future needs of visitor services, fire suppression, and other park operations. (NPS 2003)

Wetlands in the park addition lands consist of riparian areas along the Puerco River, along small seeps and springs, and along the fringes of some earthen stock tanks — depending on the nature of soil development and the types of plant and animal communities living there. Many of the natural wetlands are seasonal and may be only periodically wet. Even though many of these wetlands appear dry at times for significant parts of the year, they often provide important habitat for native plants and animals. The condition of these wetlands is largely unknown, yet localized heavy concentrations of invasive plants, especially tamarisk, suggest some of these areas are degraded.

Only limited information regarding floodplains is available for the park addition lands. Federal Emergency Management Agency and Arizona Department of Transportation have flood frequency data available for some of the washes in the area, and major flash-floods in prior years have damaged the Jim Camp Wash bridge near the southern entrance to the park. However, only light ranching infrastructure (e.g., two-track dirt roads, fences) exists on most park addition lands, and flooding poses only a minor threat to these developments. The large numbers of earthen stock tanks throughout the area are an exception; if unmaintained these tanks could fail during heavy rains. Flood conditions also tend to limit access across many of the washes, because bridges do not exist. These conditions can persist for weeks after heavy rains because of adverse soil conditions in the washes, including quicksand.

The presence of nonnative tamarisk along the riparian areas of the Puerco River has likely caused substantial morphological changes to the river and exacerbated flood conditions. Tamarisk colonizes and stabilizes stream banks, bars, and islands, thereby preventing cottonwood and willow establishment. Streambed and bank stabilization may restrict water flow and lead to increased overbank flooding by reducing the capacity of streams to adjust to changes in flow. If left unchecked, the continued spread of this invasive species along the Puerco River and other major washes would likely further modify natural floodplain dynamics in the park addition lands.

Climate change could influence the future condition of the park addition lands' water resources. As stated earlier, the Environmental Protection Agency (1998) anticipates an increase in the frequency and intensity of storms and floods in Arizona. These extreme weather events will likely exacerbate existing erosion problems along stream banks and increase the risk of stock tank failures, which could, in turn, increase sedimentation of waterways, further degrading water quality.

An increase in the variability of precipitation could result in other changes to the park addition lands' water resources. Additional rainfall, especially snow during the winter, could increase the recharge rate of regional aquifers and increase the availability of water

found in small natural pools, springs, seeps, and riparian wetlands throughout the park addition lands. However, prolonged periods of drought are also anticipated, which could lead to the periodic scarcity of these water resources.

VEGETATION AND WILDLIFE

Vegetation and wildlife are grouped together in this section because a discussion about wildlife typically involves a description of their habitat, which consists of the various vegetation communities found within the park addition lands. However, because vegetation and wildlife inventories have not been completed, this discussion focuses primarily on the broad landforms, general habitat types, and common plants and animals of the area.

The previous Land Cover Types and Hydrology map shows the approximate distribution of badlands, short-grass prairies, rivers, washes, riparian areas, wetlands, and known exotic plant concentrations found throughout the park addition lands. This map is the result of analyzing satellite imagery, along with very limited ground-truthing. Access limitations and time constraints limited the thoroughness of this mapping effort; however, the resulting map does provide a useful illustration of the broad natural resources present. This information, in combination with the vegetation mapping described below, provide the basis for understanding these aspects of the affected environment.

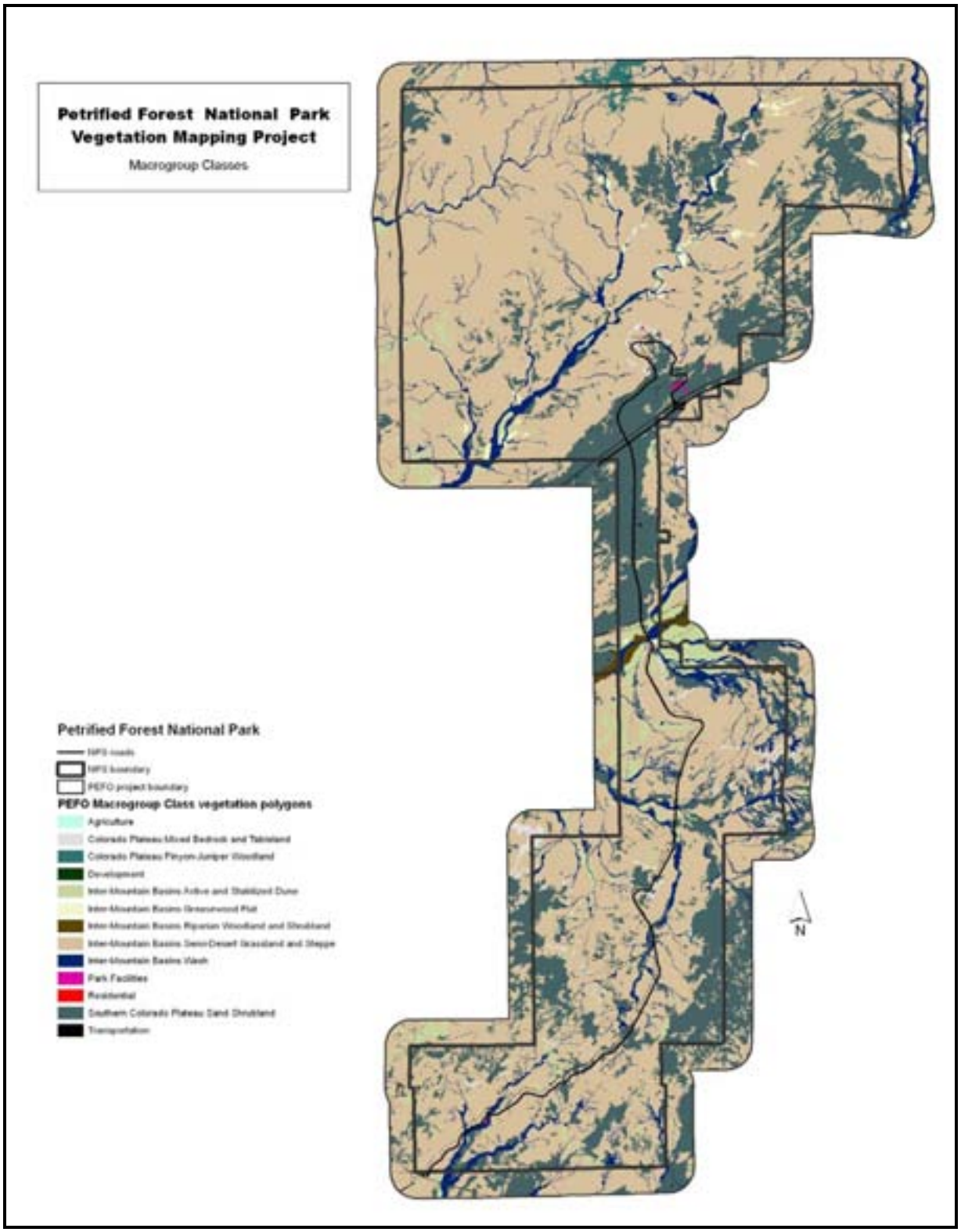
The Petrified Forest National Park Vegetation map shows the distribution of major plant communities in the pre-2004 park including a 1-mile buffer surrounding the park. This extensive mapping project, a collaborative effort involving the NPS and five partner institutions, has resulted in the most up-to-date information about the park's vegetation. As shown on the map, many of these vegetation communities extend across the pre-2004 park boundary, suggesting that these habitats would continue to extend across the remainder of the addition lands in relatively similar proportions (NPS 2009a).

Table 7 briefly describes these major vegetation classes and their proportions within the mapping project boundary (i.e., pre-2004 park and 1-mile buffer). More information about these plant communities can be found in the "Affected Environment" chapter of the park's *General Management Plan Revision* (NPS 2004).

The short-grass prairie (a component of the Inter-Mountain Basins Semi-Desert Grassland and Steppe) covers most of the park addition lands. Native vegetation in this ecosystem is characterized by species such as: alkali Sacaton, blue grama, galleta grass, golden buckwheat, and Mormon tea. In sandier soil conditions, grasses give way to a mixed desert shrubland (also referred to as the Southern Colorado Plateau Sand Shrubland), that supports plant species including four-wing saltbrush and Bigelow's sagebrush.

The park addition lands include more than 25 miles of the Puerco River. The riparian area buffering this major drainage of the park is classified as Inter-Mountain Basins Riparian Woodland and Shrubland. Willow, cottonwood, nonnative tamarisk, and Russian olive, found along historic and active river channel meanders, are typical of this area. Invasive Russian knapweed has also been found within this riparian area, adding to the list of invasive species found within the park.

Many of the cottonwood and willow stands found along the Puerco River were planted by the Civilian Conservation Corps in the late 1930s as a flood control measure. Many of these stands persist today; however, over the last 70 years only limited propagation of new plants has occurred, which is suggestive of the harshness of this environment and the effects of invasive species on limiting native plant growth. Despite this, it is estimated that the Puerco River riparian area supports the highest concentration of wildlife in the park addition lands.



Petrified Forest National Park Vegetation

TABLE 7. PETRIFIED FOREST NATIONAL PARK VEGETATION MAP CATEGORIES

Vegetation Map Categories	Description/Plant Associations	% of Land Cover (within mapping project boundary)
Inter-Mountain Basins Semi-Desert Grassland and Steppe	Alkali Sacaton — Blue Grama Herbaceous Vegetation Alkali Sacaton Herbaceous Vegetation Arizona Siltbush Sparse Dwarf-Shrubland Vegetation Barren Badlands Torrey's Jointfir — Bigelow's Sagebrush Shrubland Black Grama — Galleta Herbaceous Vegetation Blue Grama — Galleta Herbaceous Vegetation Blue Grama Herbaceous Vegetation Blue Sage Dwarf-Shrubland Galleta — Alkali Sacaton Herbaceous Vegetation New Mexico Saltbush / Galleta — Alkali Sacaton Shrub Herbaceous Vegetation New Mexico Saltbush Badland Sparse Vegetation Sand Slender Buckwheat Sparse Dwarf-Shrubland Vegetation Snakeweed — (Prickly Pear) / Galleta Dwarf-Shrubland Whipple Cholla / Alkali Sacaton Shrub Herbaceous Vegetation Winter-fat / Blue Grama Dwarf-Shrubland	66.8%
Southern Colorado Plateau Sand Shrubland	Four-wing Saltbush / Galleta Shrubland Sandsage Colorado Plateau Shrubland	22.2%
Inter-Mountain Basins Wash	Barren Wash Copperweed / Alkali Sacaton Shrubland Drummond Goldenweed / Galleta Shrubland Giant Sandreed Desert Wash Shrub Herbaceous Vegetation Rubber Rabbitbrush Desert Wash Shrubland Vegetated Wash Complex	5.5%
Inter-Mountain Basins Active and Stabilized Dune	Rubber Rabbitbrush / Blue Grama Shrub Herbaceous Vegetation Russian Thistle Sand Dune Vegetation	3.1%
Colorado Plateau Mixed Bedrock and Tableland	Cliff-rose — Crispleaf Buckwheat Shrubland Three-leafed Sumac — Mormon Tea Talus Shrubland Vegetated Rim Complex	0.7%
Inter-Mountain Basins Greasewood Flat	Greasewood / New Mexico Saltbush Shrubland Greasewood / Shrubby Seepweed Shrubland Iodine Bush Shrubland	0.5%
Colorado Plateau Pinyon-Juniper Woodland	One-seed Juniper / Bigelow's Sagebrush Shrubland	0.4%
Inter-Mountain Basins Riparian Woodland and Shrubland	Cottonwood / Rubber Rabbitbrush Woodland Coyote Willow Shrubland Tamarisk Shrubland	0.3%
Transportation	Airstrip Railroad Roads	0.4%
Park Facilities	Park Facilities Park Sites	<0.0%

Vegetation Map Categories	Description/Plant Associations	% of Land Cover (within mapping project boundary)
Agricultural Features	Runoff Control Feature Stock Ponds	<0.0%
Residential	Residences	<0.0%
Development	Commercial Development	<0.0%
	Total	**100%**

Short-grass prairie, riparian areas, and mixed desert shrubland provide needed cover and forage for many native wildlife species. Pronghorn antelope, coyotes, black-tailed jackrabbits, and desert cottontails are common to the area. Many bird species, such as flycatchers, warblers, and sparrows, migrate through the area, relying on the insects and seeds found within these habitats. Common reptiles include collard lizards, sagebrush lizards, Painted Desert whiptail lizards, and Hopi rattlesnakes.

The short-grass prairie and riparian ecosystems of the addition lands have been substantially altered during the past two centuries as a result of drought, livestock grazing, and the introduction of invasive species. During the height of the drought, vegetation density was noticeably greater immediately inside the pre-2004 park boundary. Since then, reduced livestock grazing on the addition lands have considerably improved the quality of the short-grass prairie. However, tamarisk, Russian thistle, and cheatgrass continue to spread throughout the area. Heavily concentrated in a number of locations, these invasive species have outcompeted native plants and degraded habitats for wildlife.

Because the amount of surface water in the park addition lands is limited, the availability of water from man-made stock tanks takes on additional importance to wildlife. These water sources serve as hatching areas for insects and amphibians, feeding grounds for bats, stop-over areas for migratory birds, and watering sites for larger animals — many of which have likely become habituated to the reliability of these water sources. The previous Known Existing Infrastructure map shows the distribution of stock tanks in the area.

Climate change will likely affect the vegetation and wildlife communities of the park addition lands because of projected increases in annual temperature, extreme weather, the seasonal variability of precipitation, and prolonged periods of drought. However, the rate and magnitude of these changes to specific populations of plants and animals is difficult to predict.

It is unclear how precipitation patterns will change; however, extended periods of drought could decrease vegetation cover and the availability of water for wildlife. If followed by storms, reduced vegetation cover could exacerbate erosion problems and the loss of topsoil, which could further degrade plant communities and wildlife habitat.

Warming temperatures would likely alter the composition of native vegetation and wildlife communities and increase problems related to insects and disease. Climate change could also influence the migration timing, range, and food sources of wildlife species.

The park addition lands support two wildlife species of particular management interest that are not listed as special status species by either the U.S. Fish and Wildlife Service or Arizona Department of Game and Fish. Because they are not included in the next section, "Federal and State Listed Species," a brief discussion follows.

Pronghorn Antelope

Pronghorn antelope (*Antilocapra americana*) are known to live throughout the park addition lands, supported by expansive short-grass prairies and intermittent availability of water from numerous man-made stock tanks distributed across the ranchlands. The sizes of their population and the extent of their home range have likely fluctuated considerably over time as a result of changing habitat quality, land uses, and climate patterns. Drought conditions during past years took a toll on the population because of a dramatic reduction in forage availability. This was likely compounded by competition with cattle, because this small ruminant animal feeds on succulent, high-protein vegetation also sought by livestock. Its home range has also been modified by fences, highways, and railways found within and along the border of the park addition lands. These barriers restrict pronghorn movements, reduce genetic diversity, and affect the animals' abilities to find food in areas where vegetation is sparse.

Gunnison's Prairie Dog

Several colonies of Gunnison's prairie dog *(Cynomys gunnisoni)* is known to live in the park addition lands. This prairie dog is a keystone species found within short-grass prairie ecosystems, creating habitat, providing food, and helping to keep soils and plant communities healthy. Its abandoned burrows are used by owls, weasels, snakes, badgers, and foxes. In addition, its burrowing helps to aerate the soil, add organic matter, and increase water infiltration. The prairie dog is also an important food source for coyote, weasels, foxes, hawks, eagles, and the endangered black footed ferret. The U.S. Fish and Wildlife Service has determined that Gunnison's prairie dog populations in Arizona, Utah, and certain areas of Colorado and New Mexico are not warranted for listing. However, the Park Service has determined that populations in central and south-central Colorado and north-central New Mexico are protected under the Endangered Species Act.

FEDERAL AND STATE LISTED SPECIES (INCLUDING THREATENED AND ENDANGERED SPECIES)

The Endangered Species Act of 1973, as amended, requires that federal agencies consult with the U.S. Fish and Wildlife Service before taking any action that could jeopardize the continued existence of any federally listed threatened or endangered plant or animal species. As a result, the National Park Service considers potential effects that any proposed action may have on these species. NPS policy also requires the protection of all federal candidate species, as well as state-listed special status species.

In a letter dated July 16, 2008, the U.S. Fish and Wildlife Service provided information about federally listed species that may potentially exist in Apache and Navajo Counties. The Arizona Game and Fish Department, through the Arizona Natural Heritage Program, was also consulted to provide input on state-listed species that may live in the park addition lands. In a letter dated April 24, 2008, the department provided a list of special status species that may live in this area, including a 3-mile buffer around the expanded park boundary. However, no comprehensive inventories have been conducted on the addition lands to verify the presence of any of these listed species.

Table 8 includes federal and state-listed species that may live in the park addition lands, based on information provided by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department. These determinations are also based on special status species known to live in the pre-2004 park boundary and information provided by the Navajo Nation Natural Heritage Program about endangered species that occur on Navajo Nation lands adjacent to the park addition lands. The possibility that the park addition lands could support these special status species is based on a comparison of the general habitat types found in the addition lands and the habitat requirements of these species. Based on this knowledge, table 8 does

TABLE 8. FEDERAL AND STATE LISTED SPECIES THAT MAY EXIST ON PARK ADDITION LANDS

Common Name	Scientific Name	Federal Status	Arizona Status	Habitat Requirements	Presence
Mammals					
Black-footed ferret	*Mustela nigripes*	E	WSC	grassland plains, generally found in association with prairie dogs	H
Mexican gray wolf	*Canis lupus baileyi*	E	WSC	chaparral, woodland, and forested areas — may travel through desert areas	H
Birds					
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	WSC	cottonwood/willow and tamarisk vegetation communities along rivers and streams	H
Mexican spotted owl	*Strix occidentalis lucida*	T	WSC	nests in canyons and dense forests with multilayered canopies	H
California condor	*Gymnops californianus*	E	WSC	high desert canyonlands and plateaus	H
Yellow-billed cuckoo	*Coccyzus americanus*	C	WSC	large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries)	H
Amphibians					
Chiricahua leopard frog	*Rana chiricahuensis*	T	WSC	streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs	S
Invertebrate Animals					
Giant sand treader cricket	*Daihinibaenetes arizonensis*	SC	N/A	sand dunes and sandy washes	S
Vascular Plants					
Gladiator milkvetch	*Astragalus xiphoides*	SC	SR	grasslands and alluvial plains on Chinle and Moenkopi formations, associated with badlands of broken sandstone and clay bluffs, in washes, in floodplains, or in complexes of small arroyos	D
Paper-spined cactus	*Pediocactus papyracanthus*	SC	SR	open flats in grasslands and pinyon-juniper woodlands associated with grama grass	S
Peebles Navajo cactus	*Pediocactus peeblesianus var. peeblesianus*	E	HS	gravely soils of the Shinarump conglomerate of the Chinle Formation	S
Navajo sedge	*Carex specuicola*	T	HS	silty soils at shady seeps and springs	S
Zuni fleabane	*Erigeron rhizomatus*	T	N/A	selenium-rich red or gray detrital clay soils derived from the Chinle and Baca formations	S

not include five special status fish species identified by the U.S. Fish and Wildlife Service because of the lack of suitable stream habitat found in the park addition lands (i.e., only dry washes and ephemeral streams exist).

The U.S. Fish and Wildlife Service and the Arizona Game and Fish Department use the following categories to track the special status of species that are included in table 8.

Federal Status

E Listed Endangered — imminent jeopardy of extinction

T Listed Threatened — imminent jeopardy of becoming endangered

C Candidate — has sufficient biological vulnerability and threats to support proposals for listing

SC Species of Concern — conservation status may be of concern to the U.S. Fish and Wildlife Service

Arizona State Status

HS Highly Safeguarded — no collection allowed

SR Salvage Restricted — collection only with permit

WSC Wildlife of Special Concern — species whose occurrence in Arizona is or may be in jeopardy

In addition to their federal and state status, each species has also been classified according to the likelihood of their presence within the park addition lands. These categories include:

D Documented — the species is known to live in the addition lands

S Suspected — the species may live in the addition lands based on its presence within the pre-2004 park or because of the availability of suitable habitat within the addition lands

H Historic — the species likely lived historically in the park addition lands, but is no longer found there.

A detailed description and regulatory profile of all federal listed species can be found at Abstracts, distribution maps, and illustrations for all Arizona state listed species can be found at http://www.azgfd.gov/w_c/edits/hdms_abstracts.shtml.

ARCHEOLOGICAL RESOURCES

Archeological resources have been generally impacted by a lack of systematic protection within the addition lands. Most of the addition lands have not been fully surveyed for archeological resources. Although some private landowners have been extremely conscientious about site preservation, not all sites have benefited from consistent oversight. Legal petrified wood extraction, mining, ranching, and other permitted activities on state and former Bureau of Land Management lands have impacted historic and prehistoric archeological sites. These impacts have yet to be fully documented and assessed.

Sites in the addition lands have been subject to the effects of erosion and natural processes that result from the action of wind and precipitation. Generally, most archeological resources in the addition lands have not been professionally evaluated, and there are no existing condition assessments of sites.

In the addition lands archeological resources have not yet been fully surveyed; however, based on topography and environment, there is potential for sites to be located throughout these areas.

The Archaic period began about 8,000 years ago when the landscape reflected a more desert-like environment than during previous time periods. The hunting of small- to medium-sized game dominated life. Archaic hunters left behind chipped stone artifacts on ridges and mesa tops. Generally, there was an increase in plant processing for food, which is evidenced by the appearance of metates (basins) and manos (hand-held grinding or pounding stones) for processing seeds and grains. Archaic peoples also began using plant products for clothing (woven sandals) and other items. Archaic sites related to these kinds of activities are likely to be found in the park addition lands.

Pueblo period sites (1,300 to 600 years ago) reflect a time of transition and activity around Petrified Forest. The Petrified Forest region

was in a drought during the first 250 years of this period. Residents of the area built settlements (pueblos) near arable land. In these locations throughout the addition lands there is potential to discover ancestral Puebloan sites.

Petroglyphs have been documented at a number of locations throughout the addition lands. Impacts on petroglyphs and pictographs include graffiti and natural erosion. Stylistically, in various areas of the park, petroglyphs date from to Archaic, Puebloan, and historic periods.

Known prehistoric sites include Canyon Butte ruins 1, 2, 3, and 4, and Christi's Star Rock. The detailed petroglyph panels in the area have been stylistically dated to 600 to 1,000 years before the present.

Occupation at Canyon Butte has been dated to between AD 1130 and 1325 (Pueblo III). Canyon Butte is comprised of four sites with more than 100 rooms. This site was originally recorded by Walter Hough of the Smithsonian Institution in 1901. Canyon Butte is representative of a smaller type settlement that would later aggregate into large pueblos like that found at Wallace Tank.

The Dead Wash and Puerco River drainages have good potential for archeological sites. Petroglyphs and pictographs are likely to be found along some of the talus slopes of the mesas. Other historical archeological resources may be found at the razed Pinta townsite, adjacent to the Santa Fe Railroad line, and in association with the old Fitzgerald Ranch and Paulsell Ranch headquarters.

Some limited survey has documented a number of Ancestral Puebloan homesites in the addition lands. There is a rare Chacoan Culture Great House dating back some 1,000 years to between AD 900 and 1130 in the addition lands. This Pueblo ruin maintains the distinctive "core and veneer" masonry of the Chacoan Culture, whose ceremonial center was in northwestern New Mexico. There may be other sites in the addition lands that are associated with the southwestern edge of the Chacoan system.

Addition lands formerly owned by the New Mexico and Arizona Land Company and now in private ownership include the Wallace Tank Ruin, a large Pueblo IV period ruin dating from about AD 1200 to 1325. The pueblo contains an estimated 400–600 rooms. In the past stock tank maintenance has occurred at this site resulting in the disturbance of artifacts with heavy equipment. Despite the impacts to the site, archeologists believe that a large percentage of the architecture is intact. These Pueblo IV sites in the Western Pueblo region are quite rare, and they are critical in understanding how the Western Pueblos (Hopi, Zuni, Acoma, and Laguna) developed. There is also potential for sites to be located in and around the Black Knoll area, where cinder quarrying has taken place on addition lands.

Potential for archeological sites from the historic period exist in the area of the old stage station near the former Suglia property and in relation to early development in the area along historic travel corridors. A windmill and stock tank exist near the ruins of the old stage station near the former Suglia property. Roads are evidence of ranching in the area. These developments and evidence of mining indicate a history of multiple uses.

The central portion of the pre-2004 park contains extensive evidence of historic use and travel. The 35th parallel route, followed by Whipple and Beale, crosses the park near the Painted Desert headquarters, as does the Prescott to Santa Fe mail route. Remnants of these historic resources extend into the addition lands. Other areas may include historic resources related to the Santa Fe Railroad and Route 66, which also cross the park.

Petrified wood extraction has occurred at a number of locations throughout the addition lands. Most of these sites and other quarrying locations may yield historic or archeological

resources because these activities have taken place for many centuries.

Weathering affects archeological resources throughout the park addition lands. Archeological site damage from erosion may increase as storms intensify because of climate change. Site exposure may be exacerbated by decreases in vegetative cover caused by drought. Climate change may also cause increased exposure of sites due to erosion from wind, precipitation, and increased seasonal variation. As a result, archeological information may be lost as sites are impacted by climate change.

HISTORIC STRUCTURES

Historic structures have been generally impacted by a lack of systematic protection in the addition lands. Most of the addition lands have not been fully surveyed for historic structures that may be eligible for national register listing. Although some private landowners have been extremely conscientious about site preservation (as with archeological sites), not all potential national register properties have benefited from consistent oversight. Activities related to legal petrified wood extraction, mining, ranching, and other permitted actions on state and Bureau of Land Management lands have impacted historic structures. These impacts have yet to be fully documented and assessed.

Throughout the addition lands there are few known intact historic structures. As outlined above in the discussion of archeological resources, some sites may be eligible for national register listing; however, an inventory of historic structures needs to be carried out to make this determination. At the present time, the locations with the most potential for yielding historic resources in the addition lands include the Santa Fe Railroad, the Pinta townsite adjacent to the Santa Fe Railroad line, the old Fitzgerald Ranch and Paulsell Ranch headquarters, and areas adjacent to old Route 66. Route 66 also follows the Beale Camel Trail and Overland Stage Route, which is still visible in many places today.

Historic structures may deteriorate faster if subjected to more extreme temperatures, seasonal variability in precipitation and humidity, and more intense storms caused by climate change.

VISITOR USE AND EXPERIENCE

According to NPS *Management Policies 2006*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units. The National Park Service is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks. Further, the National Park Service would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The NPS policies also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect (NPS 2006).

Visitor Use

Visitation to Petrified Forest National Park peaked in the mid to early 1990s at more than 900,000 visitors per year. Since 2001, visitation has remained relatively stable in the 500,000 to 600,000 visitors per year range. In 2008, the park had 543,714 visitors (NPS 2009b). Monthly visitation peaks in July, but visitor numbers are high throughout the summer. January and February are typically the slowest months.

There is little recent information about the characteristics of visitors at Petrified Forest National Park, but a 1997 petrified wood theft study (Roggenbuck et al. 1997) and a 2001 visitor study (Delost and Lee 2001) provide some insights. The average length of stay in the park is about 2.5 hours. Visitors tend to be highly educated, and most come in family

groups that include children. About one quarter of the groups include someone over the age of 65. Visits by seniors and school groups tend to increase during the spring and summer. About 10% of visitors are Arizona residents, with California the next most common state of residence. Petrified Forest National Park is not the primary destination for most visitors; instead the park tends to be one stop on an itinerary that includes other destinations such as Grand Canyon National Park; the Navajo and Hopi Indian reservations; and Flagstaff and Canyon de Chelly, Wupatki, Sunset Crater, and Walnut Canyon national monuments.

In the pre-2004 portion of the park, the most popular visitor activity is traveling the main park road and enjoying the scenery, with stops to see petrified wood and wayside exhibits and enjoy short hikes. Picnicking, watching wildlife, ranger-led walks, and enjoying indoor interpretive exhibits (main visitor center, Rainbow Forest Museum, and the Painted Desert Inn) are also popular activities. Day hiking and overnight backpacking are the most common backcountry experiences, but a relatively small proportion of visitors venture into the backcountry. A relatively small number of visitors ride horses in the pre-2004 national park. Much of the backcountry is managed as wilderness, and there are few maintained trails, no reliable water sources, and summer temperatures that can soar to more than 100°F. Thunderstorms can turn dry washes into rushing torrents.

The pre-2004 national park includes a gift shop, café, and gas station/mini-mart at the Painted Desert headquarters, and a gift shop and snack bar at Rainbow Forest. These concession services are provided under a contract with the National Park Service. The Petrified Forest Museum Association operates bookstores at the Painted Desert visitor center, the Rainbow Forest Museum, and the Painted Desert Inn.

There is basically no visitation in the new (addition lands) portion of the park. This is due to the current lack of public access routes; the checkerboard pattern of private, state, and federal landownership; and other barriers (interstate highway, railroad corridor, and rivers and washes). However, the park staff is interested in building its local and regional visitor constituency and hopes that expanding and diversifying visitor opportunities on the addition lands during the long term would help to accomplish this.

Over the long term, the influences of climate change could alter seasonal visitor use patterns and trends. As stated at the beginning of this chapter, the Environmental Protection Agency (1998) anticipates higher annual temperatures and possibly extended hot spells in Arizona. A higher frequency of heat waves may increase the number of heat-related illnesses and even deter visitors, particularly the elderly, from visiting the park in the summer. However, milder winters could increase visitation during the shoulder season. Types of visitor use may also change, such as a decrease in strenuous activities (e.g., backpacking) in the summer. Park operations and management may also need to adapt to effectively respond to these types of changes visitor use patterns.

Visitor Experience

Experiencing the following aspects of Petrified Forest National Park has been identified as fundamental to the visitor experience (see the "Fundamental Resources and Values" section in chapter 1):

- petrified wood deposits in a natural setting
- the renowned, colorful Painted Desert
- erosional processes that shape the landscape, and features such as mesas, buttes, badlands, lava flows, washes, and tinajas
- various ecosystems, such as short-grass prairie, shrub steppe, riparian, and badlands
- cultural landscapes

- archeological resources (petroglyphs, archeological sites)
- wilderness areas that lack trails, offer challenges, and provide opportunities for solitude
- dark night skies and natural soundscapes
- visibility — vast, expansive, open, and unobstructed views

The park addition lands could provide expanded opportunities for visitors to experience these fundamental resources and values of the park. However, currently there are no commercial or other visitor services in the park addition lands. Visitors can only enjoy the spectacular views of the addition lands from the pre-2004 portion of the park, and from existing interpretive and educational programs that include some limited information about the park expansion lands.

Of the fundamental resources and values listed above, the viewsheds, dark night skies, and natural soundscapes are discussed in more detail. This is because of the potential impacts from actions within and adjacent to the park addition lands that warrant additional analysis in "Chapter 4: Environmental Consequences."

Viewsheds. The park addition lands provide unparalleled scenic vistas because of the combination of exceptionally clear air, expansive landscapes, varied ecosystems, and the sheer distance of unobstructed views.

Dark Night Skies: The dark night skies of the addition lands also could provide visitors with outstanding opportunities for stargazing because of the lack of artificial light. These dark night skies are becoming increasingly rare throughout the country.

In accordance with NPS *Management Policies 2006*, the National Park Service strives to preserve natural ambient lightscapes, which are natural resources and values that exist in the absence of human-caused light (NPS 2006). Petrified Forest National Park strives to limit the use of artificial outdoor lighting to that necessary for basic safety requirements. The National Park Service also strives to ensure that outdoor lighting within national parks is shielded to the maximum extent possible to keep light on the intended subject and out of the night sky.

Natural Soundscapes. The natural soundscapes of the park addition lands also could enhance visitor opportunities to experience solitude and in a vast and largely undeveloped, remote desert setting.

In accordance with NPS *Management Policies 2006* and Director's Order-47: "Sound Preservation and Noise Management," an important component of the NPS mission is the preservation of natural soundscapes associated with national park units (NPS 2006).

Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among national park system units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

PARK OPERATIONS

Petrified Forest National Park is administered by a superintendent and several division chiefs who are responsible for the following seven functional areas: administration, interpretation and education, protection, fee collection, maintenance, resource management, and museum collections management. More information on the various divisions and their responsibilities can be found in the 2004 *General Management Plan Revision*. Operations are managed out of the Painted Desert

headquarters area, where most of the 53 full-time-equivalent employees are located. Because administrative functions are concentrated in the headquarters area, communication between staff is generally good. Emergency response time in the pre-expansion portion of the park is good, with protection staff stationed at both ends of the park.

Patrols of state and NPS-owned lands in the addition lands are currently performed on an infrequent basis because of access constraints and extensive private ownership. Due to the addition lands' remoteness, difficulty of access, and the need to obtain permission to cross private land, NPS staff typically "team up" for efficiency and safety when venturing into the addition lands. For example, when the park paleontologist ventures out to evaluate fossils in a particular area, the park archeologist often comes along to learn more about the location and condition of archeological sites in the addition lands.

For each subsection below, a brief description of facilities in the pre-2004 portion of the park is provided first for context (more detailed information can be found in the 2004 *General Management Plan Revision*), although these amendment alternatives propose no changes to these areas. These descriptions are then followed by a corresponding description of what is currently known about facilities on addition lands.

Developed Areas

Within the pre-expansion portion of Petrified Forest National Park, the three main developed areas are Rainbow Forest, the Painted Desert Inn, and the Painted Desert headquarters complex. Rainbow Forest is a historic developed area near the south end of the park that consists of a museum/visitor contact station; a large concessions building (gift shop, food services and restrooms); nine historic residences that serve as staff housing or offices; a materials storage building; a fire truck garage; and a picnic pavilion. The historic "Mission 66"-era Painted Desert headquarters complex, in the north portion of the park, includes the park's main visitor center, administrative offices, maintenance and storage facilities, a multipurpose community building, and 28 housing units, many of which are used as offices.

On the park addition lands, development is limited to a few widely scattered clusters of ranch buildings, plus associated fences, corrals, wells, and stock tanks. An NPS-owned former homestead, located north of Interstate 40 and southwest of the Painted Desert headquarters (Section 27, Township 19N, Range 23E), is being used as a small NPS operations base and staff residence. The other small building clusters in the addition lands remain in private ownership and have not been inventoried, assessed for condition, or evaluated for potential future adaptive NPS uses.

Trails and Roads

In the pre-expansion portion of the park, hiking trails are at Long Logs/Agate House, Giant Logs, Tawa Point (Rim Trail), Crystal Forest, Blue Mesa, Puerco Pueblo, and Kachina Point. Road access for visitors to various park attractions is provided from the main park road and its associated spurs roads. Various unpaved roads provide access to more remote areas for authorized administrative uses only.

Within the park addition lands, there are no paved or improved roads — only unimproved ranch roads and two track roads. There are also no maintained trails — only stock and game trails.

Campgrounds

In the pre-expansion portion of the park, backcountry camping is allowed by permit, but there are no designated campgrounds within the park. Campgrounds are available just outside the south park entrance, in

Holbrook, and near I-40 between the park and Holbrook.

In the park addition lands there are no campgrounds, although there are potentially suitable areas should public access routes be established in the future.

SOCIOECONOMIC ENVIRONMENT

For this analysis, the influence area for economic and social consideration associated with the Petrified Forest addition lands includes Apache and Navajo counties, including the gateway city of Holbrook that is 27 miles west of the park. Portions of the park and addition lands are in both Apache and Navajo counties. The region is largely rural and populated with small towns along the major road network that includes Interstate 40 (I-40) and U.S. Highway 180. The nearest metropolitan area is Flagstaff, which is less than a 1.5-hour drive west of Holbrook, Arizona. Both Phoenix (Arizona) and Albuquerque (New Mexico) are about 3.5 hours driving time away. A Burlington Northern Santa Fe Railroad line bisects the park and runs south of, and parallel to, I-40. The Navajo and Hopi reservation lands comprise the entire northeast portion of the state and border the park to the north.

The regional economy is largely driven by nonfarm employment and industries. A large portion of the economy is based on government employment and enterprises, transfer payments, and tourism-related industries. Personal incomes are lower than the state as a whole, and unemployment and poverty rates are higher than the state as a whole.

Population

The state of Arizona has had rapid population growth during the past 18 years, growing 77% from 1990 to 2008. Navajo and Apache counties are no exception, but they have grown more slowly than the state as a whole. Navajo County's population growth, however, was more than double that of the nation during the same time period.

Navajo County is west of Apache County, covers 9,953 square miles, and had a population of 97,470 as of 2000 (see table 9). Navajo County's population is estimated to have grown by about 16% from 2000 to 2008, and by 45% since 1990 (U.S. Census 2009a). Holbrook is Navajo County's seat and the third most populated community in the county. Holbrook had an estimated population of 5,699 in 2008, representing about 5% of county residents. The largest town in the county is Show Low, with more than 12,000 residents, which is about 70 miles south of the park via Arizona Highway 77 (AZ Dept. of Commerce 2008b). About 30% of Navajo County residents live on the White Mountain Apache, Hopi, and Navajo reservations. The projected population of Navajo County in 2025 is 157,000 people (AZ Dept. of Commerce 2009).

Apache County encompasses just over 11,200-square miles and had a population of 69,423 in 2000. The county's population is estimated to

TABLE 9. POPULATION GROWTH TRENDS, 1990-2008

	1990	2000	2008	Change 1990-2008	% Change 1990-2008
Apache County	61,591	69,423	70,207	8,616	14%
Navajo County	77,658	97,470	112,757	35,099	45%
Arizona	3,665,228	5,130,632	6,500,180	2,834,952	77%
United States	248,709,873	281,421,906	304,059,724	55,349,851	22%

Source: U.S. Census Bureau (Population Finder), 2009a

have grown by just over 1% from 2000 to 2008, and by 14% since 1990 (U.S. Census 2009a). St. Johns is the county seat and was home to 4,006 people in 2008, representing just over 5% of county residents. Eagar is the most populated town in the county, with an estimated 4,810 people in 2008, or just more than 6% of the county population (AZ Dept. of Commerce 2008b). Both St. Johns and Eagar are southeast of the park, about a 1-hour drive and a 1.5-hour drive from Holbrook, respectively. The remaining 88.4% of the county's population lives in less populated communities, unincorporated areas, or on the White Mountain Apache or Navajo reservations. Apache County is projected to have 90,167 residents by 2025 (AZ Dept. of Commerce 2009).

Economic Conditions

Apache and Navajo counties have had an overall increase in employment (number of jobs) since 1990. County employment has increased in Apache County, for example, from below 18,000 jobs in 1990 to almost 27,000 jobs in 2006, a 49% increase. Navajo County has had a similar trend, with county employment increasing by 46% during the same time period (see table 10).

During the more recent past, job growth grew by 5% between 2002 and 2006 in Apache County and by 9% in Navajo County, which is significantly lower than the total employment growth in Arizona during the same time period (17%), but more similar to that of the nation as a whole (7%).

Neither Apache County nor Navajo County has a very diverse job base. Most jobs, and compensation related to those jobs, are nonfarm related, with a substantial portion represented by government employment (see table 11). For example, Apache County's total nonfarm compensation accounts for 99.9% of

TABLE 10. TOTAL COUNTY EMPLOYMENT (NUMBER OF JOBS), 1990 TO 2006

Year	Apache County	Navajo County
1990	17,876	26,878
1994	19,663	29,164
1998	21,973	32,906
2002	25,467	35,751
2006	26,709	39,135
1990-2006 % Change	+49%	+46%

Source: U.S. Bureau of Economic Analysis, Table CA04, 2008a

TABLE 11. EMPLOYMENT BY MAJOR CATEGORY, 2006

County	Total Employment	Agriculture[a]	Industrial[b]	Trade and Services[c]	Government[d]
Apache County	26,709	2%	5%	33%	50%
Navajo County	39,135	2%	20%	51%	27%
Arizona	3,366,201	1%	26%	59%	13%
United States	178,332,900	2%	25%	60%	13%

SOURCE: U.S. Bureau of Economic Analysis, REIS, Table CA25N, Updated August 2008 (2008c)
NOTE: Apache County does not add up to 100% because some industry figures were not available to avoid disclosure of confidential information.
a. Includes farming, forestry, fishing, and related activities.
b. Includes mining, utilities, construction, manufacturing, transportation and warehousing, and administration and waste services.
c. Includes wholesale and retail trade; information services; finance and insurance; real estate and rental and leasing; professional and technical services; management of companies and enterprises; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services.
d. Includes federal, state and local government, and military personnel.

total county compensation, and of that percentage, almost 73% is a product of the government and government enterprises. Government compensation broken down by level of government is 61% state and local, 38% federal civilian, and 1% military. Compensation, in this case, is the sum of wage and salary disbursements and supplements to wages and salaries, including employer contributions for employee pensions, insurance funds, and government social insurance.

In Navajo County, 99.4% of total county compensation is nonfarm related. Of that percentage, 40% is related to government and government enterprises. Most of this compensation (72%) is at the state and local government level, whereas 26% is federal civilian and 2% is military. In both counties, local governments provided most government compensation — 96% in Apache County and 87% in Navajo County (U.S. Bureau of Economic Analysis 2008b).

Apache and Navajo counties had significant increases in per capital personal income between 2000 and 2006. Despite this, the per capita personal income in Apache and Navajo counties is the first and second lowest in the state, respectively (see table 12). Given the low personal incomes in the region, the regional economy is more reliant on outside dollars to sustain the economy, making the park's ability to draw tourists to the area a critical component of the regional economy.

In 2008, there were an average of 18,596 people employed and 2,048 people unemployed (9.9%) in Apache County (January through November). In comparison, Navajo County had an average of 36,022 people employed (January through November) and 3,276 unemployed people in 2008, an 8.3% unemployment rate. In comparison, Arizona's average unemployment rate in 2008 (January through November) was 5.0% — much lower than either Apache or Navajo counties (see table 13) (Arizona Dept. of Commerce 2008c).

TABLE 12. PER CAPITA PERSONAL INCOME, 2000-2006

	2000	2006	% Change 2000-2006	% of 2006 U.S.	2006 Statewide Rank (of 15)
Apache County	$13,564	$19,826	46%	54%	14
Navajo County	$14,516	$19,505	34%	53%	15
Arizona	$25,653	$31,936	24%	87%	NA
United States	$29,845	$36,714	23%	100%	NA

Source: U.S. Bureau of Economic Analysis. Table CA04. 2008a

TABLE 13. UNEMPLOYMENT RATES, 2000 TO 2008

	Annual Average								
Area of Interest	2000	2001	2002	2003	2004	2005	2006	2007	2008*
Apache County	9.2%	9.7%	10.9%	11.8%	11.3%	10.4%	9.7%	8.7%	10.6%
Navajo County	7.3%	7.7%	8.4%	8.5%	8.4%	8.0%	7.1%	6.4%	9.2%
Arizona	4.0%	4.7%	6.0%	5.7%	4.9%	4.6%	4.1%	3.8%	5.5%
United States	4.0%	4.7%	5.8%	6.0%	5.5%	5.1%	4.6%	4.6%	5.8%

Sources: Arizona Dept. of Commerce, Workforce Informer, LAUS Special Unemployment Report (2008c); U.S. Bureau of Labor Statistics, 2008

Arizona's statewide annual average unemployment rates are more similar to the national average than either Apache or Navajo counties, and Apache County has consistently had a higher unemployment rate than Navajo County from 2000 to 2008. In 2007, both counties had their lowest unemployment rate since 2000, 8.8% and 6.4% in Apache and Navajo County respectively. In 2007, Arizona also had its lowest unemployment rate since 2000. However, a national recession in 2008 drove unemployment levels up from their 2007 level. Unemployment rates could continue to increase throughout 2009 and possibly even 2010 if this national and global recession continues.

Despite extremely low unemployment rates in 2007, the poverty level remained very high in both Apache and Navajo counties. In Apache County, about one in four families lived below the poverty level in 2007. Navajo County's poverty level was lower than that of Apache, with an estimated 18.2% of all families living below the poverty level in 2007 (U.S. Census Bureau 2008b). The poverty level of both counties is much greater than the estimated 10.2% of families in the state living below the poverty level. If the lens through which poverty is viewed is changed from the family to the individual, the poverty level is even higher. When seen this way, Apache County's poverty rate is 33.8%, Navajo County's poverty rate is 22.8%, and Arizona as a whole has a poverty rate of 14.2% (U.S. Census Bureau 2009b).

Gateway Community

Holbrook is the main trading and services center for northeast Arizona. Holbrook is along Historic Route 66, is at the junction of four major highways, and is the gateway community to Petrified Forest National Park (AZ Dept. of Commerce 2008a). Given that Holbrook is the park's gateway community, it provides essential services for park employees and their families living in the city and those that reside in the park. Holbrook also provides most services for visitors and tourists to the park. Holbrook has 1,082 hotel rooms, 9 meeting rooms, and a municipal airport with general aviation services (AZ Dept. of Commerce 2008a).

Tourism-related industries play a significant role in the local economy. In 2006 (most recent data available), accommodation, food services, retail trade, and arts, entertainment, and recreation accounted for 22% of nonfarm employment in Navajo County (U.S. Bureau of Economic Analysis 2008b). Although county employment does not perfectly mirror Holbrook's economy, these sectors of the economy have a substantial effect on Holbrook's economy as a whole.

In addition to Petrified Forest National Park, other attractions draw visitors to the area and contribute to the local economy. Local and area attractions include Canyon de Chelly National Monument; the Hashknife Posse Pony Express Ride; the Holbrook Old West Celebration; Fireman's Barbeque; Navajo County Horse Racing; the Navajo County Fair; and Navajo and Hopi reservation attractions, including ceremonial dances, tribal events, and arts and crafts, (AZ Dept. of Commerce 2008a).

Economic Contributions of Petrified Forest National Park

The park contributes substantially to the local and regional economy. Park operations, capital expenditures, federal payments in lieu of taxes, and park visitors all play a role. During the past 10 years, the park's total annual operating budget has increased by almost 45%, to just over $2.8 million. The annual operating budget, which includes wages and benefits paid to park staff, is the largest share of the total budget. The number of park staff has fluctuated over time, but there are currently 53 full-time equivalent (FTE) employees at the park. In addition, the park often hires members of the community as seasonal staff. The park cooperating association and concessions operators also hire some of their staff from Holbrook and surrounding areas.

Petrified Forest National Park's key visitor facilities and much of its staff housing are located more than 25 miles from nearby communities. Given that the park is so isolated, it is fairly self-sufficient, operating its own wastewater treatment systems, waterlines, water storage tanks, and fire equipment. The park contributes to the regional and tribal economies by purchasing water from the Navajo Tribal Utilities Authority. The park is not, however, entirely self-sufficient and must rely on nearby communities, particularly Holbrook, for some of its employee housing and service needs. About 35 employees live in Holbrook, Joseph City, and Sanders, either in private homes or park-owned housing in Holbrook.

Visitors. In addition to direct economic stimulus in the form of employee and park spending, the park is a major economic driver in the region because of the dollars spent by visitors to the park. Visitors spend money sleeping in hotels, eating at restaurants, and purchasing gas and other items while in Holbrook or in the region; a percentage of each dollar remains in the local economy and is spent again (economic multiplier effect), increasing every dollar's overall positive impact.

The number of park visitors changes each year as a result of factors such as overall economic conditions and gas prices. The number of visitors to the park has remained in the upper 500,000 visitors/year range for the past seven years. However, the 514,714 visitors in 2008 were the fewest since 1955 when there were 441,700 visitors (NPS 2009b). (See figure 1.)

As of the end of 2007, the U.S. economy officially entered into a recession (Office of the President 2009). The recession has adversely affected economic and social conditions domestically and abroad, and Apache and Navajo counties are no exception. Nationally, the weakened economy has led to reduced consumer spending. Although the park has historically had about 500,000 visitors annually, given current and projected economic conditions, this visitation level is expected to decline somewhat in 2009 and 2010 if general economic conditions and trends do not improve. Typical visitation patterns will be disrupted as people reduce spending on nonessential items such as leisure and travel.

Travel Spending. Travel spending affects the area's employment and tax base as well as personal income. Total direct travel spending has increased in Apache County since 2002

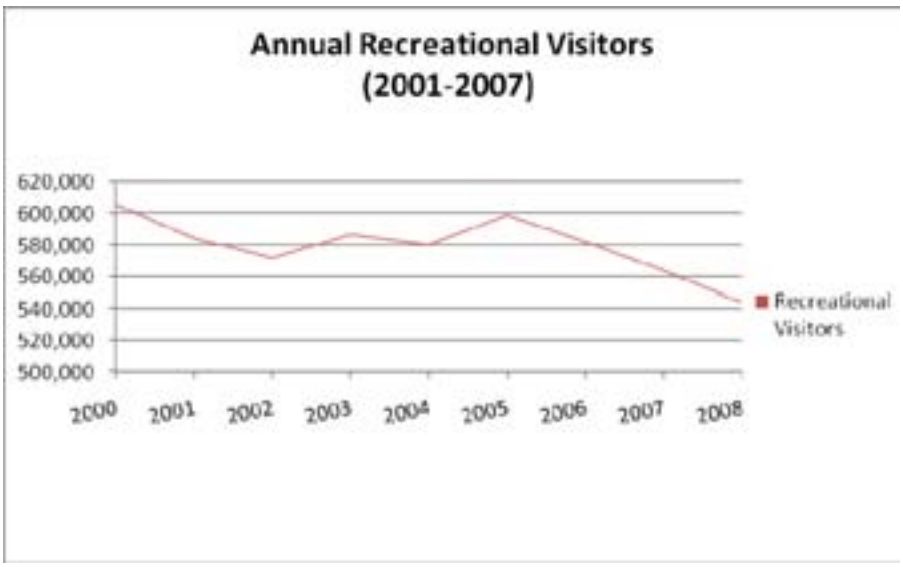


Figure 1. Annual Recreational Visitors to the National Park

and in Navajo County since 2001. In 2007, the most recent figures available, total direct spending in Apache County was $144 million and $292 million in Navajo County (Arizona Office of Tourism 2007). As a result of the current economic downturn, visitation and associated travel spending is expected to decline. This decline could be mitigated by direct marketing in the surrounding area, as well as the nearest major metropolitan areas such as Phoenix and Flagstaff, Arizona and Albuquerque, New Mexico. (See table 14.)

Concessions. The park currently has one concessioner contract with Xanterra Parks and Resorts, LLC (Xanterra) to operate two small retail stores, a gas station, and two small cafeterias in the park. As part of its operations at the park, Xanterra has developed a solid waste recycling program and a "buy local" framework that reduces environmental degradation and assists local businesses. For example, the food waste generated from the two cafeterias is given to local ranchers to help feed their animals. As a result, in 2006, more than 1,400 pounds were diverted from the landfill. In addition, Xanterra purchases locally grown flour from the Navajo reservation that is delivered in cloth bags that are returned to the reservation to be reused. Xanterra's efforts to recycle and reuse solid waste materials resulted in 76% of solid wastes being kept out of the landfill (NPS 2007b).

Museum Association. The Petrified Forest Museum Association was established and approved in 1941 by the secretary of the interior. The association is a nonprofit, nongovernmental organization whose principal objective is to aid preservation and interpretation of the park. The association operates three book sales outlets in the park at the Painted Desert visitor center, Painted Desert Inn, and Rainbow Forest Museum. The association also publishes park-specific books for sale and prints free informational materials such as the park newspaper, brochures, flyers, and site bulletins. Proceeds from the sale of publications are used to support educational and interpretive activities and research in the park.

PILT Payments. A final source of local revenue that affects the regional economy is payments in lieu of taxes (PILT) from the federal government to local governments (usually counties) to help offset losses in property taxes as a result of having nontaxable federal lands within their boundaries. Such payments help local governments pay for services such as fire and police protection. Table 15 shows the number of acres in both Apache and Navajo counties that were eligible for the PILT program and the actual payments distributed during the past three years (U.S. DOI 2008).

TABLE 14. ARIZONA COUNTY TRAVEL IMPACTS (1998–2007P)

		Related Travel-Generated Impacts				
County	Travel Spending (Millions)	Earnings (Millions)	Employment (jobs)	Local Taxes (Millions)	State Taxes (Millions)	Total Taxes (Millions)
Apache	144	30	1,720	3.1	5.5	8.7
Navajo	292	67	3,270	6.2	11	17.1

Source: Arizona Travel Impacts, AZ Office of Tourism (2007), written by Dean Runyan Associates
*Property taxes and sales taxes paid by travel industry employees not included.

TABLE 15. PILT PAYMENTS BY ALL FEDERAL AGENCIES IN APACHE AND NAVAJO COUNTIES

	2006	2007	2008
Apache County			
Acres	652,583 (63,885 NPS)	662,655 (63,885 NPS)	651,874 (63,886 NPS)
Payments	$946,414 ($92,650)*	$956,164 ($92,182)*	$1,462,097 ($143,291)*
Navajo County			
Acres	599,165 (18,904 NPS)	598,123 (18,905 NPS)	593,800 (19,064 NPS)
Payments	$744,028 ($23,475)*	$749,814 ($23,700)*	$1,335,324 ($42,871)*

Source: U.S. Department of the Interior, 2008

* This figure represents an estimate of the NPS share of the total payment; it was derived by dividing NPS acres by total PILT acres and multiplying by the total payments.

IMPACT TOPICS CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Some resource impact topics that are commonly considered during the planning process were dismissed from detailed analysis because either the management alternatives would have no effect, a negligible effect, or a minor effect on the resource, or because the resource does not occur in the park addition lands.

For purposes of this section, an impact of negligible intensity is one that is "at the lowest levels of detection, barely perceptible, and not measurable." An impact of minor intensity is one that is "measurable or perceptible, but is slight, localized, and would result in a limited alteration or would impact a limited area." The rationale for dismissing these specific topics is stated for each resource.

AIR QUALITY

The Clean Air Act of 1955, as amended, was established to promote public health and welfare by protecting and enhancing the nation's air quality. The act established programs that provide special protection for air resources and air quality-related values associated with NPS units. Section 118 of the Clean Air Act requires parks to meet all state, federal, and local air pollution standards. Petrified Forest National Park is classified as a Class I air quality area by Congress, affording the park the most stringent air quality protection possible under the Clean Air Act. Class I areas also include international parks, national wilderness areas, and other national parks larger than 6,000 acres.

The National Park Service strives to perpetuate the best possible air quality, because air pollution, even at relatively low levels, affects ecological and human health, scenic views, and visitor enjoyment. Progress toward this goal is measured by examining current conditions and trends for key air quality indicators, including ozone, visibility, and atmospheric deposition. Of these indicators, visibility at Petrified Forest National Park is of the greatest concern. Monitoring results indicate that visibility is degrading in the park, which affects how well and how far visitors can see. This is primarily attributed to regional haze from sources outside the park, including nitrogen oxide emissions from two large coal-fired power plants. These power plants are within 50 miles of Petrified Forest National Park and generate a combined total of 2,000 megawatts of electricity.

Despite these broader impacts, air quality (including visibility) would be largely unaffected by the management alternatives considered for the park addition lands. The only known sources of air quality degradation under both alternatives would be from vehicular use on two-track dirt roads, which can cause temporary dust plumes during dry conditions, and smoke from occasional burn piles associated with ranching activities. These actions would only result in short-term, negligible, adverse impacts on air quality. Combined with pollution generated by potash mining (which is reasonably foreseeable in the future), there could be minor cumulative impacts under the no-action alternative. Under the action alternative, there would be no effects from potash mining. Because any effects on air quality under the no-action alternative would be negligible in intensity, and they would not result in unacceptable impacts, this topic is dismissed from further analysis in this document.

WILD AND SCENIC RIVERS

The National Park Service is responsible for maintaining a Nationwide Rivers Inventory, which is a register of river segments that potentially qualify as national wild, scenic, or recreational river areas. None of the major rivers or dry washes in the park addition lands

are listed on this inventory, nor has a wild and scenic river eligibility assessment been completed for river segments that are in the addition lands. As described in chapter 1, this eligibility assessment of rivers and washes in the addition lands has been deferred until information about river-related resources is more complete. Until an eligibility assessment has been completed, all rivers and washes that are under NPS ownership in the park addition lands will receive interim protection so that potential outstandingly remarkable values are not diminished. Because of these considerations, wild and scenic rivers has been dismissed from further analysis as an impact topic.

PRIME AND UNIQUE FARMLANDS

In 1980 the Council on Environmental Quality directed federal agencies to assess the effects of their actions on farmland classified by the Natural Resources Conservation Service as prime or unique. Prime farmlands are defined as lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and are also available for these uses. Prime farmlands have the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Unique farmlands are lands other than prime farmland that are used for the production of specific, high-value food and fiber crops. Because the park addition lands do not contain any prime or unique farmlands, this impact topic has been dismissed from further consideration.

ECOLOGICALLY CRITICAL AREAS

In accordance with NPS *Management Policies 2006*, the National Park Service recognizes that special designations apply to parts or all of some parks to highlight the additional management considerations that those areas warrant. These include ecologically critical areas; however, there are none designated in the park addition lands. Because of this, this topic has been dismissed from further analysis as an impact topic.

CARBON FOOTPRINT

For the purpose of this planning effort, "carbon footprint" is defined as the sum of all emissions of carbon dioxide and other greenhouse gases (e.g., methane and ozone) that would result from implementation of the two management alternatives. Understanding the carbon footprint of each alternative is important to determine their contribution to climate change.

It has been determined that the management alternatives described in this document would only emit a negligible amount of greenhouse gases that contribute to climate change; therefore, this impact topic has been dismissed from detailed analysis in this plan. The reasons for dismissing this impact topic are that (1) no new road or facility construction is proposed under either alternative; (2) there would be no change in emissions from current ranching activities proposed under the no-action alternative; and (3) there would only be a small increase in gas consumption from inventory and monitoring efforts under the action alternative, and ranching activities would likely be reduced. Because of the negligible amount of greenhouse gas emissions that would result from each alternative, a quantitative measurement of their carbon footprint was determined by the planning team not to be practicable.

CULTURAL LANDSCAPES

According to NPS "Cultural Resources Management Guideline" (Director's Order 28), a cultural landscape is

> a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and types of structures that are built. The character of a cultural landscape is defined, both by physical materials such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

No cultural landscapes have yet been identified in the addition lands. Further analysis will be needed to determine if there are areas in the addition lands that lend themselves to the designation of cultural or ethnographic landscapes that might be eligible for listing as national register properties. There may be landscapes that relate to the ranching history of the area. The 2004 *General Management Plan Revision* noted that no ethnographic landscape study of the park has been initiated and, therefore, there are no known ethnographic landscapes. This situation is true for the addition lands. As with the pre-2004 park, the northern boundary of the park is the southern boundary of the Navajo Reservation. The reservations for the Hopi, Zuni, and White Mountain Apache are all within 150 miles of the park. The cultures of these people are bound to the lands once occupied by their ancestors, and certain sites in the park may be important in their ceremonial life (NPS 1993).

The only actions identified in this plan call for inventory and assessment. Any potential cultural or ethnographic landscapes would not be impacted by the alternatives in this document. Therefore cultural landscapes will not be further analyzed in this document.

ETHNOGRAPHIC RESOURCES

Ethnographic resources are defined by the National Park Service as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (Director's Order # 28, *Cultural Resource Management Guideline*, pg. 181). The identified contemporary communities with ethnographic ties to Petrified Forest National Park are the Hopi Tribe, Navajo Nation, Zuni Pueblo, and White Mountain Apache Tribe. Ethnographic resources related to the early historic period and early ranching settlements might also exist in the addition lands, but they have not yet been identified or documented. The archeological, historical, and ethnographic records reveal a long history of human use of the park area for cultural groups, spanning from the Paleoindian period to the present.

An ethnographic study completed for Petrified Forest National Park between 1998 and 2001 involved advisory teams from the Hopi, Zuni, Navajo, Acoma, and Laguna (Theuer 2006; Zedeno, et al 2001). The teams provided valuable insights about contemporary Native views on park resources. This information likely applies to the addition lands because they are adjacent and were probably occupied by the descendents of the same peoples. Although there is potential for ethnographic resources to be identified at some future date, these resources are not yet identified for the addition lands. Future tribal consultation may yet identify ethnographic resources in the addition lands. American Indian tribes traditionally associated with the lands of Petrified Forest National Park were apprised by letter dated April 15, 2008, that a *General Management Plan Amendment* would be prepared. Comments dated April 28, 2008 were received from the Hopi Tribe. Copies of the document will be forwarded to each associated tribe or group for review and comment. If subsequent issues or concerns are identified, appropriate consultations would be undertaken.

Any potential ethnographic resources would not be affected by implementation of either alternative. Appropriate steps would be taken to protect historic and indigenous ethnographic resources, human remains, funerary objects, sacred objects, or objects of cultural patrimony inadvertently discovered, ethnographic resources was dismissed as an impact topic. Therefore ethnographic resources will not be further analyzed in this document.

MUSEUM COLLECTIONS

The 2004 *General Management Plan Revision* contains a detailed discussion of the park museum collections and their current condition. Museum collections are prehistoric and historic objects, artifacts, works of art, archival documents, and natural history specimens. The park's museum collections contain nearly 128,000 cataloged items and another 55,000 uncataloged objects stored both on-site and off-site (NPS 1996).

Neither alternative in this plan amendment would result in changes to management of the museum collections at Petrified Forest National Park as previously described. Recent archeological work in the park has focused on managing and documenting archeological resources with only minimal additions to collections (see 36 CFR 79: Curation of Federally Owned and Administered Archeological Collections). The park staff will continue to collect paleontological specimens as necessary according to best practices for paleontological research. Because no changes to current collections management would result from either alternative, the topic of museum collections will not be further analyzed in this document.

AMERICAN INDIAN TRUST RESOURCES

Secretarial Order 3175 requires that any anticipated impacts on Indian trust resources from a proposed project or action by Department of the Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no Indian trust resources within the Petrified Forest National Park, including the addition lands. The lands comprising the park are not held in trust by the secretary of the interior for the benefit of Indians because of their status as Indians. Therefore, Indian trust resources was dismissed as an impact topic.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low Income Populations" requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of federal programs and policies on minority and low-income populations and communities.

Navajo and Apache counties have both minority and low-income populations and communities; however, environmental justice was dismissed as an impact topic for the following reasons:

- The planning team actively solicited public comments, including from the tribes, as part of the planning process and gave equal consideration to input from all persons regardless of age, race, ethnicity, income status, or other socioeconomic or demographic factors.
- The alternatives would not result in any disproportionate adverse impacts on minorities or low-income populations and communities. In fact, the socioeconomic analysis included in this chapter indicates that socioeconomic effects of both GMP amendment

alternatives would be minor and *beneficial*.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

The implementing regulations of the National Environmental Policy Act require that energy requirements, natural or depletable resource requirements, and conservation potential be analyzed.

The National Park Service's *Guiding Principles of Sustainable Design* (1993) provide a basis for achieving sustainability in facility planning and design, emphasizes the importance of biodiversity, and encourages responsible decisions. Sustainability can be described as the result achieved by doing things without compromising the environment or its capacity to provide for present and future generations. The guidebook describes principles to be used in the design and management of visitor facilities that emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, recycling, and integration of visitors with natural and cultural settings. Sustainable practices minimize the short- and long-term environmental impacts of developments and other activities through resource conservation, recycling, waste minimization, and the use of energy efficient and ecologically responsible materials and techniques.

Petrified Forest National Park strives to reduce energy costs, eliminate waste, and conserve energy resources by using energy efficient and cost effective technology wherever possible. Energy efficiency would also be incorporated into any decision-making process during the design or acquisition of facilities, as well as all decisions affecting park operations. Value analysis would be used to examine energy, environmental, and economic implications of proposed development. The park would encourage suppliers, permittees, and contractors to follow sustainable practices and address sustainable practices in interpretive programs.

Long-term infrastructure and development decisions would be made in a future comprehensive general management plan / wilderness study that addresses management of the pre-2004 park and the addition lands holistically. Pending completion of such a future plan, any new facilities developed by the Park Service would be minimal (e.g., restrooms, small patrol cabins, or entrance kiosks) and would be carefully sited. Any new hiking trails would be carefully sited and use existing trails and ranch roads to the extent possible. Similarly, vehicular routes for administrative use would be unimproved and would use ranch roads as much as possible. Thus, under either alternative, there would be negligible impacts on energy requirements and conservation potential. Therefore this topic was dismissed as an impact topic.

Environmental Consequences

4

INTRODUCTION

The National Environmental Policy Act of 1969 (40 CFR 1500-1508) mandates that environmental assessments disclose the environmental impacts of a proposed federal action. In this case, the proposed federal action is implementation of the general management plan amendment for the park addition lands. The alternatives in this document provide broad management direction. Thus, this environmental assessment should be considered a programmatic document. Before undertaking specific actions to implement the approved plan, NPS managers will need to determine if more detailed environmental documents must be prepared, consistent with the provisions of the National Environmental Policy Act.

The first part of this chapter discusses terms and assumptions used in the discussions of impacts. The next three parts cover policy and terminology related to cumulative impacts, impairment of national park resources, and unacceptable impacts. The third part discusses the relationship of the impact analyses to requirements of section 106 of the National Historic Preservation Act, which is referred to as the assessment of effect.

Next, the impacts of the no-action alternative and the action alternative are discussed. Each impact topic includes a description of the impacts of the alternative, a discussion of cumulative effects, and a conclusion. The impact analysis for the no-action alternative compares resource conditions 15 to 20 years in the future with existing conditions today. The impacts of the action alternative describe the difference between implementing the no-action alternative and implementing the action alternative. To understand the consequences of the action alternative, the reader must consider what would happen if no action were taken (i.e., consider the no-action alternative).

TERMS AND ASSUMPTIONS

Each impact topic includes a discussion of impacts, including the intensity, duration, and type of impact. *Intensity* of impact describes the degree, level, or strength of an impact as negligible, minor, moderate, or major. Because definitions of intensity vary by resource topic, separate intensity definitions are provided for each impact topic. *Duration* of impact considers whether the impact would occur over the short term or long term. Unless otherwise noted, s*hort-term* impacts are those that, within a short period of time (generally less than five years) would no longer be detectable as the resource or value returns to its pre-disturbance condition or appearance. *Long-term* impacts refer to a change in a resource or value that is expected to persist for five or more years. The *type* of impact refers to whether the impact on the resource or value would be *beneficial* (positive) or *adverse* (negative).

An important assumption for analyzing the action alternative is that most private lands within the park addition boundary would be acquired by the National Park Service from willing sellers. This is a primary difference from the no-action alternative, which assumes that these lands would continue to be under private ownership.

CLIMATE CHANGE

The impacts of climate change on the park addition lands are not expected to vary by alternatives, and the lack of qualitative information about the potential effects of climate change in Arizona adds to the difficulty of predicting how these impacts will be realized. The potential influences of these changes on certain park resources were included in "Chapter 3, Affected Environment," but will not be analyzed in detail with respect to each alternative.

CUMULATIVE IMPACTS

Council on Environmental Quality regulations, which implement the National Environmental Policy Act, require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes such other actions. Cumulative impacts can result from individually minor but collectively important actions taking place over a period of time.

Cumulative impacts are considered for both the no-action and the action alternatives. These impacts were determined by combining the impacts of the alternatives proposed in this document with the impacts of each alternative with the impacts of other past, present, and reasonably foreseeable future actions. To do this, it was necessary to identify these other projects or actions at the park and in the surrounding area. For the purposes of most impact topics in this analysis, the cumulative impact analysis area was Apache and Navajo counties, Arizona. The time horizon for the cumulative impacts analysis depends on the impact topic under consideration, but in most cases was plus or minus five years.

The following past, present, and reasonably foreseeable future projects were identified for the purposes of conducting the cumulative effects analysis.

Petrified Wood Mining and Removal (Past)

Petrified wood mining and collection is prohibited on federal and state lands in the park addition lands. However, petrified wood can be legally removed on private lands in the national park by landowners or with landowners' permission.

Petrified wood has been removed from the addition lands in the past. In some cases this has involved individuals carrying off relatively small pieces of petrified wood legally (on private lands with landowners' permission) or illegally (on state or federal lands, or on private lands without landowners' permission). In other cases, large petrified wood logs or log sections have been removed (mined) from private lands with backhoes or other equipment.

Deterioration of Historic Structures (Past)

Some potentially historic structures in the park addition lands that have not yet been evaluated for eligibility for the National Register of Historic Places (e.g., the Pinta station) are in a deteriorated condition because of the effects of nature and from the lack of use and maintenance.

Impacts on Archeological Sites (Past)

Impacts on archeological sites in the addition lands have occurred in the past from natural wind and water erosive processes, from illegal pot hunting and looting, and from legal removal (on private lands only, and only with landowners' permission).

Grazing (Past and Reasonably Foreseeable Future)

Cattle ranching has occurred on most of the addition lands for more than a century, and it is expected to continue into the foreseeable future.

Potash Exploration and Mining (Reasonably Foreseeable Future)

Petrified Forest National Park overlies a rich potash deposit, which is the subject of a 2008 report by the Arizona Geological Survey (Open File Report OFR 08-07, referenced in NPS 2008). The report concluded the following:

> Growing global demand for potash for use in fertilizers makes Arizona's

> Holbrook basin deposit more economically viable and attractive than previously recognized. The size of the resource . . . is many times larger than fragmentary reports have indicated.

There is reason to believe that potash exploration and development could occur in the addition lands, including on privately owned parcels in the addition lands, in the future. A publicly traded company announced in 2008 that it had entered into a mineral option agreement with a private company incorporated in Arizona to acquire a 100% interest in 13 state leases in Navajo County (comprising 8,413 acres). A second company reported that it applied for and received 15 state exploration leases on lands covering 9,594 acres in Apache County.

In late 2009, Passport Metals Inc. signed a four-year lease with an option to purchase the Twin Butte Ranch for potash mining. This ranch extends across most of the southwestern portion of the park addition lands. A press release stated that the company's first priority would be an aggressive drill program to test the thickest areas of potash in the southeast portion of the ranch (Marketwire 2009).

Residential and Commercial Development (Reasonably Foreseeable Future)

Scattered residential and commercial development has been creeping closer to the expanded Petrified Forest National Park boundary in recent decades. Most of the residential development is on the park's west side. There is a truck stop at Navajo, Arizona, just east of the expanded park on Interstate-40. The Navajo Nation is considering development of a casino and truck stop at the Pinta exit south of Interstate 40 on an escarpment overlooking the park addition lands.

Wind and Solar Energy Development (Present and Reasonably Foreseeable Future)

Iberdrola Renewables is constructing a commercial-scale wind energy project, referred to as the Dry Lake Wild Project, 18 miles southwest of Holbrook, Arizona. The project is on a combination of private, state, and Bureau of Land Management (BLM) public lands. Construction began in 2009 and was expected to be complete by the end of the year.

The NZ Legacy Company is also seeking to construct a large wind and solar generating installation in central Navajo county near the southwestern portion of the park addition lands. If permitted by the county, the company would construct as many as 475 wind turbines that extend 300 feet into the air, along with 1,430 solar reflector towers with a height of 200 feet each.

To illustrate the potential impacts of these developments on the park's viewshed, a map analyzing the visibility of NZ Legacy Company's proposed project can be found in Appendix C: Potential Visual Impacts of Wind and Solar Energy Development.

IMPAIRMENT OF NATIONAL PARK RESOURCES

In addition to determining the environmental consequences of implementing the action and no-action alternatives, NPS *Management Policies 2006* (section 1.4) requires analysis of potential effects to determine whether or not proposed actions would *impair* the national park's resources and values.

The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give NPS managers discretion to allow

impacts on park resources and values when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute impairment of the affected resources and values. That discretion is limited by the statutory requirement that the National Park Service must leave resources and values unimpaired unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that would, in the professional judgment of the responsible NPS manager, harm the integrity of park resources and or values and violate the 1916 NPS Organic Act's mandate (NPS *Management Policies 2006* 1.4.5). An impact on a park resource or value may, but does not necessarily, constitute an impairment. An impact is more likely to constitute impairment to the extent that it affects a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

Impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park. A determination on impairment is made in the conclusion section for each impact topic related to the park's cultural and natural resources. A determination of impairment is not required for impact topics such as visitor experience, the socioeconomic environment, and NPS operations.

UNACCEPTABLE IMPACTS

The impact threshold at which impairment occurs is not always readily apparent. Therefore, the Park Service applies a standard that offers greater assurance that impairment will not occur by avoiding unacceptable impacts. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Almost every type of human activity that takes place within a national park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Unacceptable impacts are impacts that, individually or cumulatively, would

- be inconsistent with park purposes or values, or
- impede the attainment of a park's desired conditions for natural or cultural resources as identified through the park's planning processes, or
- create and unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with
    - park programs or activities, or
    - an appropriate use, or
    - the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park
    - NPS concessioner or contractor operations or services

In accordance with NPS management policies, park managers must not allow uses that would cause unacceptable impacts on park resources. To determine if unacceptable impacts could occur to the resources and

values of Petrified Forest National Park, the impacts of the alternatives were evaluated based on the above criteria. A determination on unacceptable impacts is made in the "Conclusion" section for each impact topic related to the park's cultural and natural resources.

IMPACTS ON CULTURAL RESOURCES AND SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

In this environmental assessment, impacts on cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the regulations of the Council on Environmental Quality (CEQ) that implement the National Environmental Policy Act. In accordance with the Advisory Council on Historic Preservation regulations implementing Section 106 of the National Historic Preservation Act (26 CFR Section 800), "Protection of Historic Properties," impacts no historic structures were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effect that were either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse impacts.

Under the Advisory Council's regulations a determination of either adverse effect or no adverse effect must also be made for affected national register-eligible cultural resources. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies if for inclusion in the national register (e.g., diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonable foreseeable effects caused by the action alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CFR Section 800.5, Assessment of Adverse Effects). A determination of no adverse effect means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resources that qualify it for inclusion in the national register.

CEQ regulations and the National Park Service's "Conservation Planning, Environmental Impact Analysis and Decision-making" (Director's Order 12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under the National Environmental Policy Act only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although adverse effects under Section 106 may be mitigated, the effect remains adverse.

A Section 106 summary is included in the impact analysis sections for the action alternative. The Section 106 summary, which is applicable only to lands owned or managed by the National Park Service, is intended to meet the requirements of Section 106 and is an assessment of the effect of the undertaking (implementation of the alternative) on cultural resources, based upon the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

IMPACTS ON NATURAL RESOURCES

INTRODUCTION

This section analyzes the environmental consequences of the no-action and action alternatives on the natural resource components of the park addition lands. It is based on the professional judgment of park staff, NPS planners, and other specialists in the field of natural resource management. To provide a thorough analysis of these effects, this section has been organized by the five impact topics listed below, which corresponds to the natural resource topics described in "Chapter 3: Affected Environment." Similar topics have been grouped together to limit redundancy and to concisely present the analysis.

- Geologic Resources and Soils
- Paleontological Resources, including Petrified Wood and Other Fossils
- Water Resources, including Water Quality, Wetlands, Floodplains, and Streams
- Vegetation and Wildlife
- Federal and State Listed Species, including Threatened and Endangered Species

GEOLOGIC RESOURCES AND SOILS

Methods and Assumptions for Analyzing Impacts

The effects of the management alternatives on geologic resources and soils of the park addition lands are analyzed based on impacts resulting from land uses, levels of development, and limited visitor use associated with each alternative. Impacts on geologic resources and soils were evaluated by comparing projected changes resulting from the action alternative to those of the no-action alternative. The thresholds to determine the intensity of impacts are defined as follows:

***Negligible*:** The impact is barely detectable and/or would result in no measurable or perceptible changes to geologic resources or soils.

***Minor*:** The impact is slight but detectable, and/or would result in small but measurable changes to geologic resources or soils; the effect would be localized.

***Moderate*:** The impact is readily apparent and/or would result in easily detectable changes to geologic resources or soils; the effects would be localized.

***Major*:** The impact is severely adverse or exceptionally beneficial and/or would result in appreciable changes to geologic resources or soils; the effect would be regional in scale.

Impacts of the No-Action Alternative

Under the no-action alternative, the geologic resources and soils of the park addition lands would continue to be affected by ongoing land uses, particularly livestock grazing and mining. There are currently four active grazing leases that permit livestock use on most of the park addition lands, including private ranches, state lands, and BLM lands recently acquired by the National Park Service (see Grazing Allotments map in chapter 1).

Livestock grazing would continue to occur mostly in the short-grass prairies of the addition lands, resulting in reduced vegetation cover in these areas. By reducing vegetation cover, soils would continue to be more susceptible to erosion and compaction, and have decreased soil fertility because of the loss of organic matter. Livestock use would also continue to result in localized soil erosion along the banks of rivers and dry washes because of trampling. Although livestock use in the badlands of the park addition lands is less common, these areas are high in clay content and are therefore more susceptible to erosion and compaction even from limited

livestock use. The impacts of these actions would be long-term, moderate, and adverse.

There are also numerous earthen stock tanks throughout the park addition lands that were constructed to provide a water source for livestock (see Known Existing Infrastructure map in chapter 3). These tanks were primarily built with earthen dams, and if unmaintained over an extended period of time they become prone to failure during heavy rains. Under the no-action alternative, infrequent maintenance of some stock tanks could increase the potential for failures, which could cause extensive erosion immediately downstream. The impacts of these actions would be long-term, moderate, and adverse.

Under this alternative, an aggregate (cinder gravel) mine at Black Knoll would continue to disturb and remove geologic resources in the southeastern portion of the park addition lands (see Land Cover Types and Hydrology map in chapter 3). Ongoing surface mining of this basalt outcrop, along with continued livestock grazing and the possibility of stock tank failures, would result in long-term, moderate, adverse impacts on geologic resources and soils on the park addition lands. The true extent of these impacts is difficult to quantify due to the lack of accurate geologic and soil maps for the area. This lack of information also makes it difficult to make wise resource management decisions in the future.

The overall impacts on geological resources and soils from implementing the no-action alternative would be long term, moderate, and adverse.

Cumulative Effects. Some historic small-scale uranium prospecting has occurred in the western portion of the addition lands. This is evidenced by a number of bore holes near Twin Buttes, resulting in negligible impacts on geologic resources of the park addition lands.

Today, potash is considered to be the most economically viable of the area's subsurface minerals. The potash deposit in and around the park is at a depth that is feasible for conventional, mechanized underground mining operations. Mining companies are seeking to acquire potash leases in this part of the state; however, there are no actives leases on federal or state-owned portions of the park addition lands, and the state and federal government are not planning to offer such leases. Nevertheless, private lands in the park addition lands could still be mined for potash.

Although the likelihood and extent of potash mining is difficult to predict (because of factors ranging from the global potash market to local landownership patterns and access rights), there is reason to believe that potash exploration and development could occur in the future. If so, mining-related activities and infrastructure could cause adverse impacts on localized portions of the fossil-rich geologic strata that overlie the potash deposit. Although impacts would likely be localized, the footprint of the main shaft, access roads, processing facilities, and storage and waste disposal sites can cover hundreds of acres. This infrastructure would lead to substantial amounts of soil disturbance and the permanent loss of geologic strata during the initial construction phase (because of surface excavation) and during the mining operation (because of the extraction of fossil-rich material to access the potash deposit). Depending on the extent of mining, there could be long-term, moderate to major, adverse effects.

Livestock grazing has occurred on the addition lands for more than a century. Periodic droughts combined with intensive grazing in the past have caused extensive loss of vegetation cover throughout the short-grass prairies. This resulted in soil compaction, erosion, and decreased soil fertility. Although much of the park addition lands have begun to recover from intensive use by livestock, past actions have resulted in a long-term, moderate, adverse effect on soils.

Overall, the effects on geologic resources and soil of past and reasonably foreseeable actions by others would be long term, moderate, and adverse.

The effect of the no-action alternative, when combined with the impacts of past and reasonably foreseeable future actions described above, would likely result in a long-term, moderate adverse cumulative impact on geologic resources and soils of the park addition lands. The no-action alternative's contribution to this cumulative effect would be modest.

Conclusion. The no-action alternative would result in long-term, moderate, adverse impacts on geologic resources and soils on the park addition lands. The effects of other past and reasonably foreseeable actions combined with the impacts of this alternative would result in long-term, moderate, and adverse cumulative effects. This alternative's contribution to these cumulative impacts would be modest.

Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Petrified Forest National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's resources or values. There would be no unacceptable impacts on park geologic or soil resources from implementing this alternative.

Impacts of the Action Alternative

Under the action alternative, the geologic resources and soils of the park addition lands would be less affected by existing land uses, such as livestock grazing and mining. Livestock grazing would still be allowed according to existing grazing allotments unless the leases were voluntarily terminated by the lessees. However, three of the existing allotments (all but the Lithodendron Wash Allotment) are tied to ranches that are entirely within the boundary of the park addition lands. If these ranches are acquired by the National Park Service (from willing sellers), then the allotments would no longer be necessary. Therefore, under this alternative, livestock grazing would likely be reduced, decreasing the effects of livestock use (described under the no-action alternative) and resulting in a long-term, moderate, beneficial impact.

Under this alternative, stock tanks constructed to provide a water source for livestock would be evaluated to determine which tanks should be maintained, if any, to benefit native wildlife or for livestock management. Stock tanks would either be carefully deconstructed or routinely maintained to prevent future failures during heavy rains. Over the long term, the potential for stock tank failures would be reduced, decreasing the chance for causing extensive erosion immediately downstream from the failed tank. This would reduce the effects of stock tank failures on geologic resources and soils, resulting in a short-term, minor, beneficial impact.

Under this alternative, the adverse impacts of mining would be reduced because of NPS ownership within the park addition lands. On these acquired lands, NPS mining regulations would apply to mining activities, which would provide more stringent protection to geologic and other resources of the park. Collaborative efforts with the state could also decrease the likelihood of mineral leases being issued by the state that would allow mining in the park boundary. Consequently, the action alternative would have a long-term, moderate, beneficial impact.

If the Black Knoll property was willingly sold to the National Park Service, the aggregate (cinder gravel) mine at this site would be discontinued. As a result, long-term, moderate, beneficial impacts on geologic resources would occur. However, evidence of mining would remain indefinitely unless the area was returned to a more natural state through reclamation efforts.

Under the action alternative, detailed geologic and soil maps would be developed for the park addition lands. This information would allow NPS managers to better protect the fundamental geologic and soil resources of the

area. A better understanding of geologic resources and soils would also be useful in managing other important park resources, such as vegetation, wildlife, paleontological, and archeological resources. This is because different soil types and geologic strata are the basis for the distribution of these resources. As a result of this more science-based management approach, the impacts on geologic resources and soils of the park addition lands would be long term, minor, and beneficial.

Overall, the impacts of implementing the action alternative on geologic resources and soils in the addition lands would be short- and long-term, minor to moderate, and beneficial.

Cumulative Effects. The past and reasonably foreseeable future actions described under the cumulative effects section of the no-action alternative would be the same under this alternative — long-term, moderate, adverse impacts on geologic resources and soils. The effect of implementing the action alternative on geologic resources and soils of the park addition lands, when combined with these past and reasonably foreseeable actions, would likely result in long-term, moderate, adverse and short- and long-term, minor to moderate, beneficial cumulative effects. The action alternative's contribution to this cumulative effect would be small.

Conclusion. The action alternative would result in short- and long-term, minor to moderate, and beneficial impacts on geologic resources and soils on the park addition lands. When combined with other past and reasonably foreseeable actions, this alternative would have long-term, moderate, adverse and short- and long-term, minor to moderate, beneficial cumulative effects. This alternative's contribution to these effects would be small.

Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Petrified Forest National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's resources or values. There would be no unacceptable impacts on park geologic or soil resources from implementing this alternative.

PALEONTOLOGICAL RESOURCES, INCLUDING PETRIFIED WOOD AND OTHER FOSSILS

Methods and Assumptions for Analyzing Impacts

The effects of the management alternatives on paleontological resources of the park addition lands are analyzed based on impacts resulting from land uses, levels of development, and limited visitor use associated with each alternative. Impacts on petrified wood and other fossils were evaluated by comparing projected changes resulting from the actions proposed in the action alternative to those of the no-action alternative. The thresholds to determine the intensity of impacts are defined as follows:

***Negligible*:** The impact to a site with concentrations of petrified wood or a fossiliferous (potentially contains fossils) layer is at its lowest levels of detection — barely perceptible and not measurable.

***Minor*:** The impact to a site with concentrations of petrified wood or a fossiliferous layer is slight but detectable, or the impact to a site (one with dense concentrations or special kinds of petrified wood or other fossils) is barely perceptible and difficult to measure.

***Moderate*:** The impact to a site with concentrations of petrified wood or other fossils is apparent, or the impact to a site (one with dense concentrations or special kinds of petrified wood or other fossils) is detectable.

Major: The impact to a site with concentrations of petrified wood or other fossils is severe or of exceptional benefit, or the impact to a site (one with

dense concentrations or special kinds of petrified wood or other fossils) is readily apparent.

Impacts of the No-action Alternative

Under the no-action alternative, the lack of paleontological inventories and condition assessments would continue to limit the National Park Service's ability to protect petrified wood and other Late Triassic fossils on NPS owned or administered addition lands. The ability to perform these inventories and assessments in the future would likely continue to be limited primarily by access constraints across private lands. This would also continue to affect the Park Service's ability to adequately protect these fossils from illegal collection, weathering, and erosion. NPS management constraints to inventory, assess, and protect paleontological resources, along with the on-going illegal collection of petrified wood, would result in long-term, minor to moderate, adverse impacts. However, the National Park Service would have some limited opportunities to collect exposed fossils on these public lands if inadvertently found — which would allow for some additional preservation and research. Long-term, minor, beneficial effects would result from limited NPS collections and preservation of paleontological resources on NPS and state lands.

Under the no-action alternative, many of the impacts described under the geologic resources and soils section would also affect paleontological resources, such as erosion, soil compaction, and strata removal because of livestock grazing, stock tank failure, and surface mining. This is because fossil-bearing strata of the Chinle Formation extend across most of the park addition lands, and impacts on these geologic layers can impact petrified wood and other fossils they contain. This is especially true of fossils found on the surface, which can easily be trampled by cattle. The impacts of these actions would be long-term, minor, and adverse.

In Arizona, mineral rights include petrified wood. It is believed that petrified wood logs on private property in the southwest portion of the park addition lands are being (legally) excavated. Some petrified wood collection is likely occurring in other areas of the addition lands as well, although not to the extent of excavation. Because petrified wood mining is legal on private lands, there is a potential for future petrified wood mining under this alternative. Limited public access to these lands under the no-action alternative would continue to help prevent the collection of smaller pieces of petrified wood. No other known forms of mining are occurring in the fossil-bearing geologic strata of the park addition lands. Localized major, adverse, impacts would occur where petrified wood logs are being excavated.

Overall, the no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, minor, beneficial impacts on the paleontological resources of the park addition lands. Localized major adverse impacts would also result from petrified wood mining.

Cumulative Effects. In Arizona, mineral rights include petrified wood, and consequently many of the larger petrified logs have already been removed from private properties in the park addition lands. There is also evidence of past illegal petrified wood mining on state lands in the park addition. Past excavation of petrified wood logs has resulted in a long-term, major, adverse, effect.

There is potential for future potash mining to have moderate to major adverse impacts on localized portions of the fossil-rich geologic strata that overlie the potash deposit. See the geologic resources and soils section for more detail on this effect. Depending on the extent of mining, there could be the same long-term, moderate to major, adverse effects on paleontological resources as a result of mining-related activities and infrastructure.

Overall, the effects on paleontological resources of past and reasonably foreseeable

actions by others would be long term, moderate to major, and adverse. Localized major, adverse impacts would occur where petrified wood logs are being excavated.

The no-action alternative, when combined with the impacts of past and reasonably foreseeable future actions described above, would likely have long-term, moderate to major, cumulative adverse impacts on paleontological resources of the park addition lands. The no-action alternative's contribution to this cumulative effect would be modest.

Conclusion. The no-action alternative would result in long-term, minor to moderate, adverse impacts and long-term, minor, beneficial impacts on the paleontological resources of the park addition lands. When combined with the impacts of other past and reasonably foreseeable actions, this alternative would have moderate to major and adverse cumulative impacts. This alternative would add a modest contribution to these cumulative effects.

This alternative would not result in unacceptable impacts or impairment of paleontological resources, because any localized removal of petrified wood would only occur on private lands within the park addition boundary. Because these resources are not under NPS ownership, they are not national park resources, and therefore they cannot be considered in the determination of impairment.

Impacts of the Action Alternative

Under the action alternative, comprehensive paleontological inventories and condition assessments would improve the Park Service's ability to protect petrified wood and other Late Triassic fossils that occur throughout the Chinle escarpment. By knowing the locations, types, and conditions of exposed fossils, the National Park Service would be able to determine which of them are essential for collection before deterioration occurs. This could substantially improve protection of these resources and expand public and scientific knowledge of this diverse prehistoric ecosystem, resulting in long-term, moderate, beneficial effects.

Under this alternative, the potential for some increased public use of the park addition lands could result in the loss or damage to petrified wood and other fossils — either by intentional collecting or accidental trampling these resources. NPS staff would design any future public access routes away from fossil-rich areas, which would help minimize these impacts. As part of this cautious approach, paleontological inventories would be necessary before appropriate public access routes are determined. Because of the increased potential for inadvertent or deliberate visitor-related impacts, this alternative could have long-term, minor, adverse impacts on paleontological resources.

Under the action alternative, livestock grazing would likely be reduced (if voluntarily terminated by grazing allotments' lessees), decreasing the potential effects of livestock trampling on exposed fossils. This would result in a long-term, moderate, beneficial impact.

Under the action alternative, it is likely that the excavation of petrified wood logs would no longer occur. Although there are petrified-wood mineral rights in the park addition lands, NPS regulations would apply if the surface estates of these properties are acquired from willing sellers. Under the authority of 36 C.F.R. 1.6, special use permits issued for the removal of nonfederal minerals must contain terms and conditions that protect park resources. As a fundamental park resource, it would be difficult to foresee that removal of petrified wood would be allowed on NPS lands. As a result, this alternative would have long-term, moderate, beneficial impacts on this paleontological resource.

Overall, the action alternative would result in long-term, moderate, beneficial effects and long-term, minor, adverse effects on the paleontological resources of the park addition lands.

Cumulative Effects. The past and reasonably foreseeable future actions described under the cumulative effects section of the no-action alternative would be the same for the action alternative — long-term, moderate to major, and adverse.

The effect of the action alternative, when combined with the past and reasonably foreseeable actions described above, could result in long-term moderate beneficial and long-term minor to major adverse cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Conclusion. The action alternative would result in long-term, moderate, beneficial effects and long-term, minor, adverse effects on the paleontological resources of the park addition lands. When combined with other past and reasonably foreseeable actions, there would be long-term, moderate, beneficial and long-term, minor to major adverse cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Proposed actions would not result in impairment of park paleontological resources. There would be no unacceptable impacts on paleontological resources.

WATER RESOURCES

Methods and Assumptions for Analyzing Impacts

The effects of the management alternatives on water-related resources of the park addition lands are analyzed based on impacts resulting from land uses, levels of development, and limited visitor use associated with each alternative. Impacts on streams, water quality, wetlands, floodplains, and riparian areas were evaluated by comparing projected changes resulting from the action alternative to those of the no-action alternative.

Streams, water quality, wetlands, floodplains, and riparian areas are analyzed together because of the similarities of these resources, their interrelationship to each other, and their collective effect on the overall hydrologic systems of the park. For example, the health of a riparian area not only influences the ability of a floodplain to store and release water, but also affects bank stability, which contributes to the natural sinuosity of a stream. Healthy riparian vegetation can also filter pollutants before reaching a stream, which in turn affects water quality. Also, many riparian areas are often referred to as wetlands, depending in part on the duration their soils remain saturated each year. Because these water-related resources are so entwined, the following impact thresholds have been developed for analyzing all of them. Please note that vegetation and wildlife components of riparian areas are also analyzed under the later vegetation and wildlife section.

Negligible: Streams, water quality, wetlands, floodplains, and riparian areas would not be impacted, or the impacts would be either undetectable or if detected, the effects would be considered slight, local, and short term. Any measureable changes would be within the natural range of variability.

Minor: Impacts on streams, water quality, wetlands, floodplains, and riparian areas would be small, short term, and localized. Natural processes, functions, and integrity would be temporarily affected, but would be within the natural range of variability. Any changes would require considerable scientific effort to measure and have barely perceptible consequences.

Moderate: Impacts on streams, water quality, wetlands, floodplains, and riparian areas would be readily apparent, long term, and localized. Natural processes, functions, and integrity would be affected, but would be only temporarily outside the natural range of variability.

Major: Impacts would have permanent consequences for streams, water

quality, wetlands, floodplains, and riparian areas that could not be mitigated. Changes would be readily measurable, outside the natural range of variability, have substantial consequences, and be noticeable on a regional scale.

Impacts of the No-action Alternative

Under the no-action alternative, the lack of natural resource inventories and condition assessments would continue to diminish the ability to protect and restore streams, water quality, wetlands, floodplains, and riparian areas on publically owned portions of the addition lands. The ability to perform these inventories and assessments in the future would continue to be limited by access constraints across private lands. The National Park Service would still have some limited opportunities to protect and restore water-related resources on public lands; however, the benefits from these efforts would be limited to small areas rather than throughout the park addition lands. Adverse impacts on water resources from livestock grazing, nonnative species, stock tank failure, and dump sites described below would be expected to continue. The lack of adequate resource information and management constraints associated with fragmented ownership would continue to result in long-term, minor, adverse impacts on water-related resources.

Under this alternative, water-related resources would continue to be affected by use by livestock on most of the park addition lands, including private ranches, state lands, and BLM lands recently acquired by the National Park Service (see Grazing Allotments map in chapter 1). Livestock use would continue to result in soil erosion along the banks of rivers and dry washes because of trampling and soil compaction. This could affect stream channel function, sediment transportation, water quality, and floodplain dynamics — all of which influence natural flow regimes, the distribution of plants and animals, and the general ecological health of the area. Livestock grazing would also continue to reduce vegetation cover in riparian areas and along wetlands (including the edges of the man-made earthen stock tanks). By reducing vegetation cover, these areas would be more susceptible to erosion and less capable of filtering pollutants (including livestock waste), which could degrade water quality. Resulting impacts would be long term, moderate, and adverse. However, the intensity of these effects largely depends on the duration and intensity of livestock use, which is currently lower than historic levels.

The introduction of nonnative tamarisk along the riparian areas of the Puerco River has likely caused substantial structural changes to the river channel and exacerbated flood conditions. Streambed and bank stabilization may restrict water flow and lead to increased overbank flooding by reducing the capacity of streams to adjust to changes in flow. If left unchecked, the continued spread of this invasive species along the Puerco River and other major washes could further modify natural floodplain dynamics within the park addition lands, resulting in long-term, moderate, adverse impacts.

The numerous earthen stock tanks throughout the park addition lands function as wetlands, which provide important habitat for many native species in the area. However, infrequent maintenance of some stock tanks could increase the potential for failures, which could cause extensive erosion immediately downstream from the tank. This could result in short-term, moderate, adverse impacts by temporarily degrading water quality (i.e., increased turbidity and release of any accumulated pollutants), altering the natural sinuosity of rivers and washes and reducing the availability of water for wildlife and foraging areas for waterfowl.

Under the no-action alternative, water quality could also continue to be impacted by several dump sites on private properties within the park addition lands. These sites include

abandoned vehicles, trailers, oil drums, tires, trash, and other miscellaneous ranching equipment. Materials that may be associated with these dump sites could cause surface and groundwater contamination by leaching into the soils or washing into streams during heavy rains. Although these sites have not been monitored for pollutants, there is a potential for localized water quality degradation to occur. Given the lack of information on the dump sites and potential pollutants, the duration and intensity of any adverse effects are unknown.

Overall, implementing the no-action alternative would have long-term, minor to moderate, adverse impacts on streams, water quality, wetlands, floodplains, and riparian areas. Long-term minor to moderate beneficial effects and some localized major adverse impacts could also occur.

Cumulative Effects. Livestock grazing has occurred on the park addition lands for more than a century. Heavy use by livestock in the past led to the loss of vegetation cover, eroded the banks of rivers and dry washes, and contaminated water sources. However, the true extent of these impacts is difficult to determine because of the lack of resource inventories and assessments. Although much of the park addition lands have begun to recover from this more intensive historic use, this past action has resulted in a long-term, moderate, adverse effect on streams, water quality, wetlands, floodplains, and riparian areas. The introduction of tamarisk along the riparian areas has also contributed to these effects.

The potential for future potash mining could impact the water resources of the park addition lands because of the groundwater requirements necessary for extraction, processing, storage, and waste disposal. This additional demand on either the Puerco River Alluvial Aquifer or the Coconino Regional Aquifer would compound the extensive withdrawal of groundwater that is already occurring from two major power generating stations in Joseph City and St. Johns — as well as from a number of smaller wells both in and outside the park that tap these aquifers. These impacts would be long term, moderate, and adverse.

Impacts on the water quality of the Puerco River occurring mostly upstream from the park addition lands include wastewater discharges from municipal sewage treatment facilities, stormwater runoff from roads, livestock use on other nearby ranches, and atmospheric deposition from regional air pollution. Future potash mining could also contaminate surface and groundwater, further degrading water quality. These impacts would be long term, major, and adverse.

Radioactive contamination of the Puerco River has also degraded its water quality. Potential sources of this pollutant include natural erosion of uranium bearing rock, waste products from uranium mine dewatering processes, and the one-time release of uranium into the Puerco River from a collapsed tailing-pond retention dam in 1979 at the Church Rock Uranium Mill (located east of Gallup, New Mexico). This catastrophic release of uranium wastewater 30 years ago may still pose a threat to the park's water resources. This past event likely caused long-term, major, adverse impacts.

Depending on the extent of these past, present, and reasonably foreseeable actions, overall there could be long-term, moderate to major, adverse effects on water resources of the park addition lands.

The effect of the no-action alternative, when combined with the past, present, and reasonably foreseeable future actions described above, would likely result in long-term, moderate to major, adverse cumulative impacts and long-term, minor to moderate, beneficial cumulative effects. The no-action alternative's contribution to these cumulative effects would be small.

Conclusion. The no-action alternative would result in long-term, minor to moderate, adverse impacts on streams, water quality,

wetlands, floodplains, and riparian areas. Long-term minor to moderate beneficial effects and some localized major adverse impacts could also occur. When combined with other past and reasonably foreseeable actions, there could be long-term, moderate to major, adverse and long-term minor to moderate beneficial cumulative effects. The no-action alternative's contribution to these cumulative effects would be small.

Proposed actions would not result in impairment of park water resources. There would be no unacceptable impacts on park water resources.

Impacts of the Action Alternative

Under the action alternative, comprehensive inventories, assessments, and monitoring of streams, water quality, wetlands, floodplains, and riparian areas would improve the Park Service's ability to protect and restore these resources. To make wise future management decisions, a better understanding is needed of flow regimes, flooding frequencies and intensities, stream channel dynamics, surface and groundwater interactions, and sources of pollution. More information is also needed about the location and condition of small seeps and springs, the species composition of riparian and wetland areas, and appropriate techniques to improve their condition. For instance, more information is needed about the distribution of tamarisk in riparian and wetland areas, and monitoring is needed to determine the most effective management for the eradication of tamarisk. The impacts of comprehensive inventories, assessments, and monitoring would be long term, moderate, and beneficial.

Under this alternative, the park addition lands would substantially increase the number of miles of rivers and washes that are under NPS ownership, increasing from 29 to 88 total miles. The NPS management responsibility along the Puerco River alone would increase from less than 2 miles to more than 27 miles. This more contiguous ownership would allow a more ecosystem-based approach to managing the park's water resources, including a broader and more effective riparian management strategy. This scientific, ecosystem-based management strategy could substantially improve the protection and restoration of water-related resources. Impacts would be long term, moderate, and beneficial.

Additional benefits under this alternative could include a reduction in use by livestock (if voluntarily terminated by grazing allotments' lessees), which would decrease the effects of livestock trampling along streambanks, vegetation loss in riparian areas, and contamination of surface water from waste. Cleaning up dump sites would also reduce the potential contamination of surface and groundwater within the park addition lands. Impacts would be long term, moderate, and beneficial.

Under this alternative, stock tanks would be evaluated to determine which tanks, if any, should be kept and routinely maintained to prevent future failures during heavy rains. Over the long term, the potential for stock tank failures would be reduced, decreasing the chance for causing extensive erosion immediately downstream from the failed tank. This would reduce the adverse effects of stock tank failures on stream channels and floodplains. If stock tanks are maintained over the long term, they would continue to provide important wetland habitat throughout the park addition lands — an overall long-term, moderate, beneficial effect.

Overall, the impacts of implementing the action alternative would be long term, moderate, and beneficial.

Cumulative Effects. The effects of past, present, and reasonably foreseeable actions by others described under the no-action alternative would be the same for this alternative — long-term, moderate to major, adverse effects on water resources of the park addition lands. The effect of the action alternative, when combined with the effects of other past, present, and reasonably foreseeable actions by

others, would likely result in moderate to major, adverse and long-term, moderate, beneficial cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and it would not contribute to the adverse cumulative effects.

Conclusion. The action alternative would result in long-term, moderate, beneficial effects. When combined with other past, present, and reasonably foreseeable actions, this alternative would have long-term, moderate to major, adverse cumulative effects and long-term, moderate, beneficial cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Petrified Forest National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's resources or values. There would be no unacceptable impacts on park water resources.

VEGETATION AND WILDLIFE

Methods and Assumptions for Analyzing Impacts

Vegetation and wildlife are addressed together in this section because an analysis of potential impacts on wildlife typically involves a discussion of wildlife habitat, which consists of the various vegetation communities found within the park addition lands. Threatened and endangered species associated with these habitats are discussed separately under the next impact topic. Impacts on vegetation and wildlife were evaluated by comparing projected changes resulting from the action alternative to those of the no-action alternative. The thresholds used to determine impacts on these resources are defined as follows:

Negligible: There would be no observable or measurable impacts on native species, their habitats, or the natural processes sustaining them. Any effects would be well within natural fluctuations.

Minor: Impacts would be detectable, but they would not be expected to be outside the natural range of variability or have any lasting effects on native species, their habitats, or the natural processes sustaining them. Population numbers, genetic variability, and other demographic factors for species might have small changes, but they would remain stable and viable. Occasional responses to disturbance by some individuals could be expected. Sufficient habitat would remain functional to maintain viability of native species.

Moderate: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be temporarily outside the natural range of variability. Population numbers, genetic variability, and other demographic factors for species might change, but would be expected to rebound to pre-impact numbers and to remain stable and viable over time. Frequent responses to disturbance by some individuals could be expected. Sufficient habitat would remain functional to maintain viability of native species.

Major: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for extended periods of time or permanently. Population numbers, genetic variability, and other demographic factors for species might be substantially changed. Frequent responses to disturbance by many

individuals would be expected. Loss of habitat might affect the viability of at least some native species.

Impacts of the No-Action Alternative

Under the no-action alternative, the lack of vegetation and wildlife inventories and habitat condition assessments would continue to diminish the ability to protect species and restore their habitats on publically owned portions of the park addition lands. The ability to gather information about these biological resources would be limited by access constraints across private lands. The National Park Service would still have some opportunities to protect and restore plant and animal communities on public lands; however, the benefits would be limited to small-scale efforts. The lack of adequate resource information and management constraints associated with limited public ownership would result in long-term, minor, adverse impacts on vegetation and wildlife.

Of the three major vegetation types in the park addition lands, the riparian areas (classified as Inter-Mountain Basins Riparian Woodland and Shrubland) would continue to be affected by invasive, nonnative plant species. In particular, the spread of tamarisk along the Puerco River would continue to limit the propagation of new cottonwoods and willows, while suppressing the overall native plant diversity of these areas. This would continue to degrade important habitat for wildlife species by modifying natural cover and reducing forage. Because riparian areas support the highest concentration of wildlife in the park addition lands, the ongoing effects of tamarisk and other invasive plants could reduce the viability of a wide range of bird, mammal, amphibian, and reptile species that depend of these areas. These impacts would continue to be long term, moderate, and adverse.

The short-grass prairie ecosystem of the park addition lands would also continue to be affected by the spread of invasive plant species, including Russian thistle and cheatgrass. These species outcompete native plants and degrade habitat for wildlife, such as the availability of forage for pronghorn antelope. The lack of active control measures to limit the spread of invasive species in short-grass prairies and riparian areas (including the edges of stock tanks) would result in long-term, moderate, adverse impacts on vegetation and wildlife.

Under this alternative, native vegetation and wildlife would continue to be affected by livestock use on most park addition lands (see Grazing Allotments map in chapter 1). As a result of livestock grazing, there would continue to be reduced vegetation cover in short-grass prairies and riparian areas, localized vegetation trampling, the introduction and spread of nonnative plants, and competition with native species (like pronghorn) for limited forage. These effects would continue to influence the populations of native plants and animals, especially during droughts and other harsh conditions when resources are most limited. The extent of these impacts largely depends on the duration and intensity of livestock use, which is currently lower than historic levels. Under current conditions, ongoing livestock use would continue to result in long-term, minor to moderate, adverse impacts on vegetation and wildlife.

Infrastructure/facilities/fences in the park addition lands would also continue to affect vegetation and wildlife species. Barbed wire fences throughout these lands act as barriers that restrict wildlife movement, especially pronghorn. This can disrupt migration patterns and influence population distributions, which can in turn affect foraging patterns in different areas, indirectly affecting vegetation communities. As a result of fences, there would continue to be long-term, minor, adverse impacts on wildlife and vegetation.

On the other hand, earthen stock tanks provide a reliable water source for wildlife and suitable conditions for some wetland plant species that are resilient to livestock use. Although stock tanks provide artificial water

sources that can negatively influence natural ecosystem dynamics (e.g., increase the population of one species that in turn decreases the population of another), many native species have become dependent on these watering sites for survival. Without them, species such as pronghorn antelope would likely have lower populations in the park addition lands. Stock tanks would continue to have long-term, minor to moderate, beneficial impacts on wildlife. Without vegetation and wildlife inventories, it is difficult to quantify the benefit of stock tanks to any particular species, such as wetland plants or waterfowl.

Under the no-action alternative, limited public access to the park addition lands would continue to minimize visitor-related disturbances to wildlife and vegetation trampling, resulting in long-term, minor, beneficial impacts. Although some motorized vehicle and foot traffic does occur throughout the park addition lands, generally it is infrequent and for limited management purposes.

Under this alternative, public access for hunting would continue to be limited to individuals given permission from private ranch owners (see Surface Ownership map in chapter 1). If permitted by the rancher, these hunters are also allowed to hunt on state lands within the ranch in accordance with state hunting laws. However, hunting is no longer legal on former BLM lands because of the recent transfer of these lands to the National Park Service. (NPS policy does not allow for hunting within most national parks, including Petrified Forest National Park.) Because hunting pressure is currently at such low levels, there would continue to be long-term, negligible, adverse impacts on wildlife from this activity.

Overall, the impacts of implementing the no-action alternative on vegetation and wildlife would continue to be long term, moderate, and adverse and long term, minor to moderate, and beneficial.

Cumulative Effects. Livestock grazing has occurred on the park addition lands for more than a century. Heavy use by livestock in the past led to the widespread loss of vegetation cover throughout short-grass prairies and riparian areas. The spread of invasive species by livestock, compounded by periodic drought conditions, also reduced the forage availability for wildlife. The true extent of these impacts is difficult to determine because of the lack of resource inventories and assessments. Although much of the park addition lands have begun to recover from this more intensive livestock use, this past action has resulted in a long-term, moderate, adverse effect on vegetation and wildlife

The potential for future potash mining could also impact vegetation and wildlife communities of the park addition lands through localized habitat loss necessary for extraction, processing, storage, transportation, and waste disposal facilities. This fragmentation of habitat, along with disturbances to wildlife from noise, artificial lights, and vehicular traffic associated with these mining activities, would continue to have long-term, moderate to major, adverse effects on wildlife and vegetation.

Past and the potential for future residential and commercial development in and adjacent to the park addition lands could further fragment vegetation and wildlife communities. For example, the home range of pronghorn antelope is easily affected by fences, highways, railways, buildings, and other infrastructure. These developments restrict pronghorn antelope movement and reduce the availability of forage in short-grass prairies (through loss of habitat). These existing developments, along with the reasonably foreseeable expansion of new developments, would continue to have long-term, moderate, adverse cumulative effects on vegetation and wildlife.

The potential for further groundwater withdrawal from new residential and commercial developments (including potash mining) could lower the water table along the Puerco River, affecting riparian vegetation growth and the availability of water for wildlife species. These additional demands on the

groundwater system underlying and adjacent to the park addition lands could result in long-term, moderate, adverse effects on vegetation and wildlife.

Depending on the extent of these past and reasonably foreseeable future actions, there could be long-term, moderate to major, adverse effects to vegetation and wildlife resources of the park addition lands. The effect of the no-action alternative, when combined with the past and reasonably foreseeable future actions described above, would likely result in long-term, moderate to major, adverse and long-term, minor to moderate, beneficial cumulative effects. The no-action alternative's contribution to these cumulative effects would be small.

Conclusion. The no-action alternative would continue to result in long-term, moderate, adverse impacts and long-term, minor to moderate, beneficial effects on vegetation and wildlife. When combined with other past and reasonably foreseeable future actions, this alternative would have long-term, moderate to major, adverse and long-term, minor to moderate, beneficial cumulative effects. The no-action alternative's contribution to these cumulative effects would be small.

Proposed actions would not result in impairment of park vegetation and wildlife resources. There would be no unacceptable impacts on park vegetation and wildlife resources.

Impacts of the Action Alternative

Under the action alternative, comprehensive vegetation and wildlife inventories and condition assessments that give a better understanding of plant and animal associations, rangeland conditions, species distributions, invasive species concentrations, for example, would improve the National Park Service's ability to protect and restore native species and their habitats throughout the park addition lands. This resource information would be used to develop strategies to improve resource conditions, such as the removal of invasive species to promote the establishment of native vegetation and the removal of barbed-wire fences to allow for unrestrained wildlife movement. Impacts would be long term, moderate, and beneficial.

Under this alternative, the amount of riparian and short-grass prairie habitat under NPS management would increase. This expanded ownership would allow for a more ecosystem-based approach to managing the park's vegetation and wildlife resources, including a broader and more effective riparian and rangeland management strategy. Another benefit under the action alternative includes a reduction in livestock grazing (if voluntarily terminated by grazing allotment lessees), which would decrease vegetation loss and competition with wildlife for limited forage. Impacts would be long term, moderate, and beneficial.

Stock tanks would also be evaluated to determine which tanks, if any, should be routinely maintained for the benefit of wildlife and vegetation communities. The maintenance of select stock tanks to provide a sufficient network of year-round water for wildlife and suitable conditions for wetland plant species would result in long-term, moderate, beneficial effects to these species.

Under the action alternative, there is potential for some increased public use of the park addition lands, which could result in visitor-related disturbances of wildlife and vegetation. NPS staff would likely locate any future public-use areas away from sensitive areas, which would help minimize these impacts. As part of this proactive management approach, vegetation and wildlife inventories would need to occur before appropriate types of recreational use are allowed. Because of the slightly increased potential for inadvertent or deliberate visitor-related impacts, this alternative could have long-term, minor, adverse impacts on vegetation and wildlife resources.

Under this alternative, hunting would no longer be allowed on the park addition lands because of NPS policy, which does not allow for hunting within most national parks, including Petrified Forest National Park. Because hunting is at such low levels already, the discontinuation of hunting would cause only a slight decrease in disturbance, resulting in a negligible benefit for wildlife.

Overall, there would be a long-term, moderate, and beneficial impact from implementing the action alternative. Potential future visitor-related impacts could be long-term, minor, and adverse.

Cumulative Effects. The effects of past, present, and foreseeable action by others on vegetation and wildlife described under the no-action alternative would be the same for this alternative — long-term, moderate to major, adverse effects. The effect of the action alternative, when combined with these other actions, would likely result in long-term, moderate to major, adverse and long-term, moderate, beneficial cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Conclusion. The action alternative would result in long-term negligible to moderate beneficial effects. When combined with other past and reasonably foreseeable actions, this alternative would have moderate to major adverse cumulative impacts and long-term moderate beneficial cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Proposed actions would not result in impairment of park vegetation and wildlife resources. There would be no unacceptable impacts on park vegetation and wildlife resources.

FEDERAL AND STATE LISTED SPECIES

Methods and Assumptions for Analyzing Impacts

Federal and state listed species are addressed together in this section because the species that may inhabit the park addition lands have dual federal and state status. Many of them live in the same habitats, or they would be affected similarly by the actions of each alternative. Impacts of each alternative are analyzed based on the effects of land uses, levels of development, and limited visitor use on the habitat requirements and behaviors of these species.

It is important to note that gladiator milkvetch (a federal listed species of concern) is the only special status species documented in the park addition lands. All other special status species are either suspected to inhabit these lands or inhabited them historically. Although many of these listed species have not been seen in the park addition lands, there is still potential for certain species to move through or attempt to take up residence in the area — such as the southwestern willow flycatcher. For this reason, no individual federal or state listed species have been dismissed from this analysis to ensure that the potential impacts of each alternative are considered. However, because of the lack of information about the presence of these species, it is difficult to know the true impacts of each alternative. Consequently, the analysis is general in nature rather than specific to each species (see table 8 in chapter 3).

For federal listed and candidate species, impact thresholds are defined separately based on terminology from Section 7 of the Endangered Species Act, as described below:

No effect: When a proposed action would not affect a federal listed species, candidate species, or designated critical habitat.

May affect/not likely to adversely affect: Effects on federal listed or candidate

species are discountable (i.e., extremely unlikely to occur and are not able to be meaningfully measured, detected, or evaluated) or are completely beneficial.

May affect/likely to adversely affect: Adverse effects on a federal listed or candidate species may occur as a direct or indirect result of proposed actions and the effects are either not discountable or completely beneficial.

Is likely to jeopardize proposed species/adversely modify proposed critical habitat (impairment): The appropriate conclusion when the National Park Service or the U.S. Fish and Wildlife Service identifies situations in which the proposal could jeopardize the continued existence of a federal listed or candidate species or adversely modify critical habitat to a species within or outside park boundaries.

The following impact threshold definitions are used to describe the severity and magnitude of changes to federal and state listed species under each alternative. Each threshold definition references the Endangered Species Act determinations described above for federal listed species. Separate threshold definitions are provided for both adverse and beneficial impacts to provide additional details about the susceptibility and response of at-risk species to alternative management actions.

Negligible: Adverse impact — There would be no observable or measurable impacts on federal or state listed species, their habitats (including critical habitat designated under the Endangered Species Act), or the natural processes sustaining them. For federal listed species, this impact intensity would equate to a determination of "no effect" under section 7 of the Endangered Species Act.
Beneficial impact — There would be no observable or measurable impacts on federally listed species, their habitats, or the natural processes sustaining them. For federal listed species, this impact intensity would equate to a determination of "no effect" under section 7 of the Endangered Species Act.

Minor: Adverse impact — Impacts would not affect critical periods of life-cycle processes (e.g., reproduction) or their habitat. Individuals may temporarily avoid areas. Essential features of critical habitat would not be impacted. For federal listed species, this impact intensity would equate to a determination of "may affect / not likely to adversely affect" under section 7 of the Endangered Species Act.
Beneficial impact — Impacts would result in slight increases to the viability of the species. Limiting factors (e.g., habitat loss, competition, and mortality) are kept in check. Nonessential features of critical habitat would be slightly improved. For federal listed species, this impact intensity would equate to a determination of "may affect / not likely to adversely affect" under section 7 of the Endangered Species Act.

Moderate: Adverse impact — Individuals may be impacted by disturbances that interfere with critical life-cycle processes or their habitat; however the level of impact would not result in a physical injury, mortality, or extirpation from the park. Some essential features of designated critical habitat would be reduced; however the integrity of the habitat would be maintained. For federal listed species, this impact intensity would equate to a determination of "may affect / likely to adversely affect" under section 7 of the Endangered Species Act.
Beneficial impact — Impacts would result in slight increases to viability of the species. Limiting factors (e.g., habitat loss, competition, and mortality) are reduced. Some essential features of critical habitat would be improved. For federal listed species, this impact intensity would equate to a determination of "may affect / not likely to adversely affect" under section 7 of the Endangered Species Act.

Major: Adverse impact — Individuals may suffer physical injury or mortality or populations may be extirpated from the park. Essential features of designated critical habitat would be reduced, affecting the integrity of the designated unit. For federal listed species, this impact intensity would equate to a determination of "may affect / likely to adversely affect" under section 7 of the Endangered Species Act.
Beneficial impact — Impacts would result in highly noticeable improvements to species viability, population structure, and population levels. Limiting factors (e.g., habitat loss, competition, and mortality) are eliminated. All essential features of critical habitat would be improved. For federal listed species, this impact intensity would equate to a determination of "may affect / not likely to adversely affect" under section 7 of the Endangered Species Act.

Impacts of the No-Action Alternative

Under the no-action alternative, the lack of information about the presence of special status species would continue to diminish the ability to protect rare species and restore their habitats on publically owned portions of the park addition lands. The ability to gain this data would continue to be limited by access constraints across private lands. Resulting impacts would be long term, minor, and adverse.

The National Park Service would still have some opportunities to aid in the recovery of special status plants and animals; however, the benefits would be limited to small-scale efforts on public parcels. The lack of adequate resource information and management constraints associated with limited ownership would result in long-term, minor, adverse impacts on federal and state listed species if they are identified in the park addition lands.

Under the no-action alternative, the continued spread of invasive plant species could degrade essential habitat for rare species. For example, by outcompeting and modifying the habitats of small populations of special status plants, invasive species (such as tamarisk, Russian thistle, and cheatgrass) could further isolate and reduce the viability of these species. Gladiator milkvetch and paper-spined cactus are particularly prone to these impacts, because they inhabit open grasslands, which are susceptible to invasive plant infestations when disturbed. Because of on-going livestock disturbances in the park addition lands (see Grazing Allotments map in chapter 1), it is likely that these long-term, minor to moderate, adverse impacts could continue to occur.

Along with contributing to the spread of invasive plants, continued use by livestock could also trample special status plants. The extent of these impacts largely depends on the duration and intensity of livestock use, which is currently lower than historic levels. Under current conditions, ongoing use by livestock could continue to result in long-term, minor to moderate, adverse impacts on federal and state listed plant species that are present.

Invasive nonnative species could also continue to affect special status wildlife species. As noted earlier, tamarisk is well established and continues to spread along the riparian areas of the Puerco River; these areas may provide suitable habitat for the southwestern willow flycatcher and yellow-billed cuckoo. Without active control measures to stop the spread of tamarisk, impacts on federal and state listed wildlife species, if present, would continue to be long term, moderate, and adverse.

Under the no-action alternative, continued ranching could potentially conflict with the recovery of some federal and state listed species that may have historically inhabited the park addition lands, such as the Mexican gray wolf and black-footed ferret (if these species reinhabit the area). Although the wolf is not currently being considered for

reintroduction within the expanded park boundary, an experimental nonessential population has been introduced about 100 miles south of the park in the Apache National Forest, as part of the U.S. Fish and Wildlife Service's Blue Range Wolf Recovery Project. If the wolf naturally disperses to the park addition lands in the future, its presence could cause ranchers concern because of the potential for livestock depredation. According to USFWS rules, ranchers may legally kill or injure a wolf that is in the act of killing, wounding, or biting their cattle, sheep, horses, mules, or burros on their private lands (USFWS 2006). Although the future presence of Mexican gray wolves within the park addition lands is uncertain, there is at least some potential for individual wolves to suffer injury or mortality under the no-action alternative, which (according to the impact thresholds described at the beginning of this section) could result in a major adverse impact.

The black-footed ferret, if present, may also be a potential concern for ranchers because of their association with prairie dogs — which are considered a nuisance species by ranchers. Several colonies of Gunnison's prairie dog are known in the park addition lands; however, no surveys have been conducted to determine if they are occupied by ferrets. Because of ranchers' concerns with prairie dog colonies, it is unlikely that prairie dogs could become further established on private ranchlands within the expanded park boundary under this alternative. Although the black-footed ferret is not currently being considered for reintroduction within the expanded park boundary and its future presence is uncertain, potential control measures of prairie dog colonies by ranchers could interfere with the life-cycle processes of individual ferrets by reducing or eliminating their food supply. Depending on the extent to which prairie dogs are controlled, continuation of the no-action alternative could result in an indirect, moderate to major adverse impact on the black-footed ferret.

Under the no-action alternative, limited public access to the park addition lands would minimize visitor-related disturbances to special status wildlife species, if present. The southwestern willow flycatcher could be susceptible to public use near nesting sites in riparian areas, but not such use is anticipated. This is also true for the Mexican spotted owl, California condor, and yellow-billed cuckoo during the nesting season. It is unlikely that these species are present in the park addition lands because of their habitat requirements. Visitor-caused trampling of special status plant species would also be limited under this alternative, resulting in long-term, minor, beneficial impacts on federal and state listed species, if present.

Although some motorized vehicle and foot traffic does occur in the park addition lands, generally it is infrequent and for limited management purposes. Some recreational impacts have been identified in the northwestern portion of the park addition lands from illegal all-terrain vehicle use, but it is uncertain if this occurred only in the past or if it is ongoing. Because of the presence of gladiator milkvetch in this northwestern area, localized, moderate, adverse impacts could continue.

Overall, the effects on federal and state listed species in this alternative, if they are present on the park addition lands, would be long term, minor to moderate, and adverse and long term, minor, and beneficial.

Cumulative Effects. Many of the past and reasonably foreseeable actions by others described in the previous vegetation and wildlife section are similar for federal and state listed species. As noted earlier, livestock have grazed on the park addition lands for more than a century. Heavy use by livestock in the past led to the widespread loss of vegetation cover throughout short-grass prairies and riparian areas. The spread of invasive species by livestock, compounded by periodic drought conditions, further degraded habitats essential for special status species. Surrounding residential and commercial

developments, such as highways, railways, buildings, and other infrastructure, though sparse, further fragmented these habitats. As a result, the park addition lands continue to lack the suitable habitat necessary for many of these rare species. The true extent of these past impacts is difficult to determine because of the lack of resource inventories and assessments about special status species. Although the park addition lands have begun to recover from more intensive use by livestock, this past action (along with surrounding residential and commercial developments) could have resulted in long-term, moderate to major, adverse impact on federal and state listed species.

The potential for future potash mining could also impact federal and state listed species (if they are present in the park addition lands). Impacts could result from localized habitat loss necessary for extraction, processing, storage, transportation, and waste disposal facilities. Habitat fragmentation and disturbances from noise, artificial lights, and vehicular traffic associated with these mining activities could have long-term, moderate to major, adverse effects — depending on the species present and the location and extent of mining operations.

Depending on the degree of these past and reasonably foreseeable future actions, there could be, overall, long-term, moderate to major adverse effects on federal and state listed species, if present.

The effect of the no-action alternative, when combined with the impacts of past and reasonably foreseeable future actions described above, could result in long-term, moderate to major, adverse and long-term, minor, beneficial cumulative effects. However, this would depend on the species present. The no-action alternative's contribution to these cumulative effects would be small.

Conclusion. The no-action alternative would have long-term, minor to moderate, adverse impacts and long-term, minor, beneficial effects on federal and state listed species if they are present on the park addition lands.

When combined with other past and reasonably foreseeable actions, this alternative could contribute to moderate to major, adverse and long-term, minor, beneficial cumulative effects. However, this would depend on the presence of listed species. The no-action alternative's contribution to these cumulative effects would be small.

Proposed actions would not result in impairment of park threatened or endangered species. There would be no unacceptable impacts on park threatened or endangered species.

Impacts of the Action Alternative

Under alternative B, information acquired from comprehensive vegetation and wildlife inventories and condition assessments would improve the National Park Service's ability to identify and protect federal and state listed species. For those species that documented in the park, an understanding of their population numbers, distributions, conditions, and threats could then be used to develop strategies that aid in their recovery, such as the removal of tamarisk in riparian areas to improve potential habitat for the southwestern willow flycatcher. Resulting impacts would be long term, minor to moderate, and beneficial.

This alternative would also substantially increase the amount of public ownership in the park addition lands, allowing for a more ecosystem-based approach to managing essential habitats for special status species. Another benefit under the action alternative would include a reduction in livestock grazing (if voluntarily terminated by grazing allotment lessees), which would decrease the potential for spreading invasive species —which can outcompete and modify the habitats of populations of special status plants. The potential for livestock trampling of special status plants, such as the gladiator milkvetch, would also decrease under this alternative, resulting in

long-term, minor to moderate, beneficial impacts on federal and state listed plant species, if present.

Under the action alternative, a reduction in control measures by ranchers to protect livestock may lessen the potential for harm to federal and state listed species. Examples described under the no-action alternative include the potential for direct mortality to the Mexican gray wolf and interference with the life-cycle processes of the black-footed ferret. Reducing the potential for harm to these species could result in a long-term moderate beneficial impact.

The potential for increased public use of park addition lands could result in visitor-related disturbances to special status wildlife species, if present. Visitor-caused trampling of special status plant species could also increase under this alternative. NPS staff would locate any future public use areas away from areas that include essential habitat for these species, which would help minimize these impacts. As part of a cautious management approach, special status species inventories would need to occur before appropriate types of recreational use are allowed. Because of the increased potential for visitor-related impacts, this alternative could have long-term, minor, adverse impacts on federal and state listed species, if present.

Overall, impacts on federal and state listed species, if present in the park addition lands, would be long term, minor to moderate, and beneficial, and long term, minor, and adverse.

Cumulative Effects. The effects of other past and reasonably foreseeable actions by others on federal and state listed species described under the no-action alternative would be the same for this alternative — long-term, moderate to major adverse effects on federal and state listed species, if present. The effect of the action alternative, when combined with the past and reasonably foreseeable future actions described above, would likely result in long-term, minor to major, adverse and long-term, minor to moderate, beneficial cumulative effects. However, this would depend on the presence of listed species. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

Conclusion. The action alternative could result in long-term, minor to moderate, beneficial effects, and long-term, minor, adverse effects on federal and state listed species if identified in the park addition lands. When combined with other past and reasonably foreseeable actions, this alternative could contribute to minor to major, adverse, and long-term, minor to moderate, beneficial cumulative effects. The action alternative's contribution to the beneficial cumulative effects would be substantial, and its contribution to the adverse cumulative effects would be small.

These adverse and beneficial impact intensities would equate to a determination of "may affect / not likely to adversely affect" under section 7 of the Endangered Species Act.

Proposed actions would not result in impairment of park threatened or endangered species. There would be no unacceptable impacts on park threatened or endangered species.

IMPACTS ON ARCHEOLOGICAL RESOURCES AND HISTORIC STRUCTURES

ARCHEOLOGICAL RESOURCES

Methods and Assumptions for Analyzing Impacts

Certain important research questions about human history can only be answered by the actual physical material of cultural resources. Archeological resources have the potential to answer, in whole or in part, such research questions. An archeological site can be eligible to be listed in the National Register of Historic Places (national register) if the site has yielded, or may be likely to yield, information important in prehistory or history. Archeological sites are typically listed for their information potential; however, other national register significance criteria may apply relevant to the site's association with important events and/or persons, or for importance in design and/or construction.

All available information on archeological resources was compiled from planning documents, research reports, and consultation with park resource specialists.

Impacts are described in terms of duration (short term or long term), type (beneficial or adverse), context (site specific, local, or regional), and intensity (negligible, minor, moderate, or major). For archeological resources short-term impacts are those that, within a short period of time, would no longer be detectable as the resource returns to its predisturbance condition or appearance — generally less than five years. Long-term impacts refer to a change in a resource or its condition that is expected to persist for five or more years. The thresholds for the intensity of an impact are defined as follows:

Negligible: The impact is at the lowest levels of detection — barely measurable with no perceptible consequences, either adverse or beneficial, on archeological resources. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor: The impact is measurable or perceptible, but slight and localized within a relatively small area of a site or group of sites. The impact does not affect the character-defining features of a national register-eligible or -listed archeological site and would not have a permanent effect on the integrity of any archeological sites. The section 106 determination of effect would be no adverse effect.
Beneficial impact — maintenance and preservation of a site(s). For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate: The impact is measurable and perceptible. The impact changes one or more character-defining features of an archeological resource but does not diminish the integrity of the resource to the extent that its national register eligibility is jeopardized. The section 106 determination of effect would be adverse effect.
Beneficial impact — stabilization of a site(s). For purposes of Section 106, the determination of effect would be no adverse effect.

Major: The impact is substantial, noticeable, and permanent. For national register eligible or listed sites, the impact changes one or more character-defining feature, diminishing the integrity of the resource to the extent that it is no longer eligible for listing in the national register. The section 106 determination of effect would be adverse effect.
Beneficial impact —active intervention to preserve a site(s). For purposes of Section 106, the determination of effect would be no adverse effect.

Impacts of the No-action Alternative

Management of archeological resources would continue according to current policies. Most of the areas under current park management would only be accessed by park staff, so there would be virtually no impacts on archeological resources from visitor use. Under the no-action alternative, the archeological resources of the park addition lands would continue to be affected by current land use practices that include livestock grazing and mining. Impacts would include the destruction or substantial damage to sites from these activities. Damage could be inadvertent or intentional and might include the destabilization of site features and other artifacts, the compaction of cultural deposits, and the creation of roads across sites. Archeological sites on private lands would still be subject to landowner uses such as excavation resulting in destruction or damage of archeological sites from digging and intentional removal of artifacts. Some of the larger known sites, such as Wallace Tank, Canyon Butte, and the Pinta townsite, could still be subject to unauthorized access. Unauthorized access may cause inadvertent or intentional damage to sites, such as site destabilization, removal or displacement of artifacts, and the compaction of cultural deposits, as well as the creation of social trails (which can lead to erosion and destabilization of the original site fabric). Sites in the addition lands would not be identified and may receive little protection or active management.

Under the no-action alternative many archeological sites in the addition lands would continue to be subject to vandalism and pothunting. Sites would also not be documented and stabilized by professional archeologists when subject to the forces of natural erosion. The destruction of archeological sites and the information they can yield, whether caused by natural events or human interaction.

Archeological resources would continue to be at risk for negative impacts. Impacts would be site specific, adverse, and long term, and would range from minor to major depending on the site and the type of impact activity.

A potentially beneficial impact would result from continued limited public access to archeological sites. Sites would be protected and not subject to inadvertent or intentional damage due to the limited access. Private landowners would continue to limit access to their lands. There would be no general access to sensitive archeological resources because of the checkerboard landownership pattern and limited legal access to NPS-managed lands. Impacts from controlled access would be long term, beneficial, and minor.

Overall, impacts from implementing the no-action alternative would be long term, minor to major, site specific, and adverse because of current management and long term, minor, and beneficial because of the limited public access.

Cumulative Impacts. Archeological resources in the Petrified Forest National Park addition lands are subject to impacts from a variety of natural events and human activities. The other past, present, and reasonably foreseeable future actions related to continued livestock grazing and its associated activities, mining, pothunting, vandalism, and natural erosion all contribute to deterioration of archeological resources.

Livestock grazing would continue to occur mostly in the short-grass prairies of the addition lands. It is in these areas that Archaic, Puebloan, and Navajo archeological sites are likely to be discovered. Livestock grazing would continue to result in the trampling and destruction of fragile archeological resources. Sites that are currently undisturbed could be destroyed. Activities associated with livestock, such as stock tank maintenance or failure, road maintenance, and other ranching activities, would have similar impacts. Actions associated with mining and petrified wood extraction could also negatively impact archeological sites. Mining and petrified wood extraction are allowed uses on private property in the addition lands. The impacts

from continued mining and livestock grazing could have potential long-term, localized, minor to major adverse impacts on a national register-eligible archeological site.

Overall, the impacts of other past, present, and reasonably foreseeable actions would have long-term, site-specific, minor to major, adverse impacts.

When combined with the adverse and beneficial impacts of implementing the no-action alternative, there would be long-term, moderate to major, adverse, and site-specific cumulative impacts. The no-action alternative would contribute a substantial increment to these cumulative effects.

Conclusion. Long-term impacts related to livestock grazing, mining, repeated vandalism and pothunting, and natural erosion would continue to be site specific and adverse, and would range from minor to major. There would be site-specific, adverse, moderate to major cumulative impacts. The no-action alternative would contribute a substantial increment to these cumulative effects.

Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Petrified Forest National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's resources or values. Because these resources are not under NPS ownership, they are not NPS resources, and therefore they cannot be considered in the determination of impairment. There would be no unacceptable impacts on the park's archeological resources from implementing this alternative.

Impacts of the Action Alternative

Under the action alternative, the archeological resources in the park would be identified through intensive archeological survey, which would lead to greater protection of such resources. Only through identification of archeological sites can they be effectively managed and protected. Impacts would be site specific and beneficial and range from minor to moderate, depending on the site and type of impact activity. As a result of this more science-based management approach, there would be long-term, minor to moderate, beneficial effects on archeological resources of the park addition lands.

Assuming that as the addition lands come into NPS management, additional survey and documentation would occur and livestock grazing and mining would be diminished or possibly cease. Thus there would be benefits to archeological resources because there would be no loss of surface archeological materials, alteration of artifact distribution, or reduction of contextual evidence within the addition lands. This impact would be long term, moderate, and beneficial.

Under this alternative, the adverse impacts of mining would be reduced because of NPS ownership or management of most lands within the park addition lands. On these acquired lands, NPS and federal mining regulations would apply to subsurface minerals, which would more stringently protect the park's archeological resources. Collaborative efforts with the state could also decrease the likelihood of mineral leases allowing mining within the park boundary on state lands. Impacts would be long term, moderate, and beneficial.

Archeological sites adjacent to or easily accessible from visitor use areas or trails could be vulnerable to inadvertent damage and vandalism. A loss of surface archeological materials, alteration of artifact distribution, and a reduction of contextual evidence could result. Such adverse impacts could be mitigated through additional stabilization of the sites, the elimination of social trails to disturbed or vulnerable sites, and supervised visits. Continued ranger patrol and emphasis on visitor education regarding the importance

and fragility of such resources and how visitors can reduce their impacts to them would help discourage vandalism and inadvertent impacts and minimize adverse impacts. Adverse impacts could be negligible to minor and permanent.

As appropriate, archeological surveys and/or monitoring would precede any ground disturbance. National register eligible or listed archeological resources would be avoided to the greatest extent possible during all construction activities. If such resources could not be avoided, an appropriate mitigation strategy would be developed in consultation with the appropriate state historic preservation officer and, as appropriate, any Indian tribes traditionally associated with park lands. If during construction previously unknown archeological resources were discovered, all work in the immediate vicinity of the discovery would be halted until the resources could be identified and documented and, if the resources cannot be preserved *in situ*, an appropriate mitigation strategy would be developed. Because construction-related impacts on archeological resources would be avoided to the greatest extent possible, no adverse impacts would be anticipated.

Overall, the impacts of implementing the action alternative would be long term, moderate, and beneficial.

Cumulative Effects. The past, present, and reasonably foreseeable future actions described under the cumulative effects section of the no-action alternative would be the same under this alternative — long-term, site-specific, minor to major, adverse impacts. The effects of the action alternative, when combined with these other past, present, and reasonably foreseeable actions would likely result in long-term, site-specific, minor to major, adverse cumulative effects on archeological resources of the park addition lands. The action alternative's contribution to this cumulative effect would be small.

Conclusion. Closer monitoring, informed management, directed use based on inventory and documentation of archeological sites, and likely reduced mining and grazing would provide long-term, moderate, beneficial impacts on archeological resources. Cumulative effects would be long term, site specific, minor to major, and adverse. The action alternative's contribution to these cumulative impacts would be small.

Section 106 Summary. After applying the Advisory Council On Historic Preservation's criteria of adverse effects (36 CFR 800.5 *Assessment of Adverse Effects*) the National Park Service concludes that implementation of the action alternative would result in no adverse effect on archeological resources. NPS staff would work with the state historic preservation officer to prevent an adverse effect.

There would be no impairment of the park's archeological resources or values from implementing this alternative. There would be no unacceptable impacts on archeological resources from implementing this alternative.

HISTORIC STRUCTURES

Methods and Assumptions for Analyzing Impacts

Impacts are described in terms of duration (short term or long term), type (beneficial or adverse), context (site specific, local, or regional), and intensity (negligible, minor, moderate, or major). The thresholds for the intensity of an impact are defined as follows:

Negligible: The impact is at the lowest levels of detection — barely perceptible and not measurable. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor: The impact does not affect the character-defining features of a national-register-eligible or listed building, structure, or district. The section 106 determination of effect would be no adverse effect.

Beneficial impact — stabilization/ preservation of character-defining features in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be no adverse effect.

Moderate: For a national register-eligible or -listed building, structure, or district, the impact changes a character-defining feature(s) of the resource, but does not diminish the integrity of the resource to the extent that its eligibility is jeopardized. The section 106 determination of effect would be adverse effect.
Beneficial impact — rehabilitation of a structure or building in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be no adverse effect.

Major: For a national register-eligible or -listed building, structure, or district, the impact changes a character-defining feature(s) of the resource, diminishing the integrity of the resource to the extent that it is no longer eligible for listing. The section 106 determination of effect would be adverse effect.
Beneficial impact — restoration of a structure or building in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. For purposes of Section 106, the determination of effect would be no adverse effect.

Impacts of the No-action Alternative

The surveys and research necessary to determine the eligibility of a structure for listing in the National Register of Historic Places is a prerequisite for understanding the resource's significance, as well as the basis of informed decision-making in the future regarding how the resource should be managed. Such surveys and research would generally not be performed for structures on non-NPS-managed addition lands. Resultant impacts to historic structures could be long term, adverse, and of minor to moderate intensity.

Most of the areas under current park management would only be accessed by park staff, and there would be little, if any, visitor use impacting historic structures. Uses by current private landowners would continue. Under the no-action alternative, any historic structures in the park addition lands would continue to be affected by current land use practices, which might include occupation and/or neglect. Historic structures would continue to be at risk for negative impacts such as deterioration due to lack of maintenance, unsupervised uses, and damage from vandalism. Impacts would be site specific and adverse, and would range from minor to major, depending on the site and the type of impact activity.

A potentially beneficial impact would result from continued administrative access to historic structures in the areas where the National Park Service has current ownership or management. Access would be minimal and supervised, causing less detrimental effects to the structures. Impacts would be long term, beneficial, and minor.

Overall, impacts on historic structures from implementing the no-action alternative would be long term, site specific, minor to major (depending on site and activity), and adverse and long term, minor, and beneficial because of controlled access.

Cumulative Impacts. Historic structures in the Petrified Forest National Park addition lands are subject to impacts from a variety of past, present, and reasonably foreseeable natural events and human activities, such as vandalism and unsupervised use. Use of some structures and lack of maintenance and evaluation of historic structures would continue.

Overall, impacts of other actions would result in long-term, site-specific, minor to major, adverse impacts. When combined with the impacts of the no-action alternative, site-specific, long-term, minor to major, and adverse cumulative impacts would result. The no-action alternative's contribution to these impacts would be slight to substantial.

Conclusion. Impacts related to historic structures and districts because of existing uses would continue to be long term, site specific, minor to major, and adverse and long term, minor, and beneficial. Cumulative impacts would be site specific, long term, minor to major, and adverse. The no-action alternative's contribution to these impacts would be slight to substantial.

Because there would be no major, adverse impacts to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of Petrified Forest National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents, there would be no impairment of the park's resources or values. There would be no unacceptable impacts on historic structures.

Impacts of Action Alternative

The surveys and research necessary to determine the eligibility of a structure for listing in the National Register of Historic Places is a prerequisite for understanding the resource's significance, as well as the basis of informed decision-making in the future regarding how the resource should be managed. Impacts on historic structures from completing these surveys and research would be beneficial and long term. This would constitute a minor, long-term, localized, beneficial impact.

Potential adaptive reuse of these buildings would require modifications to buildings, which if not properly designed and implemented could change character-defining historic features. To appropriately preserve and protect national register listed or eligible historic structures, all stabilization, preservation, and rehabilitation efforts would be undertaken in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (1995). Any materials removed during rehabilitation efforts would be evaluated to determine their value to the park's museum collections and/or for their comparative use in future preservation work at the sites. Stabilization, preservation, and rehabilitation would have long-term beneficial impacts upon historic structures. These actions could have minor to moderate, long-term, localized, beneficial impacts on historic structures.

Historic structures could suffer wear and tear from increased visitation, but monitoring the capacity of historic structures could result in the imposition of visitation levels or constraints that would contribute to the stability or integrity of the resources without unduly hindering interpretation for visitors. Unstaffed or minimally staffed structures could be more susceptible to vandalism. Continued ranger patrol and emphasis on visitor education regarding the importance and fragility of such resources and how visitors can reduce their impacts on them, would help discourage vandalism and inadvertent impacts and minimize adverse impacts. Adverse impacts would be negligible to minor and long term.

Overall, the action alternative would have long-term, minor to moderate, beneficial effects on historic structures.

Cumulative Impacts. The past, present, and reasonably foreseeable future actions described under the cumulative effects section of the no-action alternative would be the same under this alternative —long-term, site-specific, minor to major, adverse impacts on any identified historic structures and historic districts.

The effect of the action alternative, when combined with these other past, present, and

reasonably foreseeable actions, would likely result in long-term, minor to moderate, beneficial cumulative effects on historic structures and districts of the park addition lands. The action alternative's contribution to this cumulative effect would be small.

Conclusion. The action alternative would result in long-term, minor to moderate, beneficial effects on the national register-eligible historic structures in the park addition lands. When combined with the impacts of other past, present, and reasonably foreseeable actions, this alternative would have long-term, minor to moderate, beneficial cumulative effects on historic structures and districts of the park addition lands. The action alternative's contribution to this cumulative effect would be small.

Section 106 Summary. After applying the Advisory Council ON Historic Preservation's criteria of adverse effects (36 CFR 800.5 *Assessment of Adverse Effects*) the National Park Service concludes that implementation of the action alternative would result in no adverse effect on historic structures.

There would be no impairment of the park's resources or values from implementing this alternative. There would be no unacceptable impacts on historic structures from implementing this alternative.

IMPACTS ON VISITOR USE AND EXPERIENCE

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Petrified Forest National Park was established to preserve, protect, and provide opportunities to experience significant paleontological resources, archeological sites, and scenic and natural resources, and to foster scientific research and public understanding and appreciation of park resources. The methods for assessing impacts on visitor use and experience are based on how the no-action and action alternatives would affect visitors, particularly with regard to visitors' enjoyment of the park's fundamental resources and values, including viewsheds, dark night skies, and natural soundscapes. The impacts are based on the professional judgment of park staff and other NPS specialists and on public comments. The thresholds for this impact assessment are defined as follows:

Negligible: Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Changes in visitor use and/or experience would be readily apparent. Visitors would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and have substantial consequences. Visitors would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

IMPACTS OF THE NO-ACTION ALTERNATIVE

From the perspective of park visitors' experiences, there would be essentially no change unless the surrounding scenery was altered by land use changes on private property in the addition lands. (In this case, impacts would likely be minor and adverse, especially if changes to scenery were apparent from only a few limited locations.) Under the no-action alternative, the park addition lands would remain essentially off-limits to visitors because of the lack of public access routes; the checkerboard pattern of private, state, and federal land; and barriers such as the interstate highway, railroad, and rivers/washes. There would be no new visitor opportunities or interpretive programs, and therefore no stimulus for changes in visitor use, resulting in negligible to minor adverse effects on visitor use and experience.

Under the no-action alternative, the likeliest source of unnatural sound would be from vehicular traffic along Interstate 40 and train traffic along the Burlington Northern Santa Fe Railway — both of which bisect the park and addition lands. Noise from heavy equipment operating on private property in association with small-scale construction and maintenance would also be noticeable on occasion. Minor adverse impacts on natural soundscapes would continue from these activities.

The transportation routes described above would equally continue to have minor adverse impacts on the night skies and viewshed of the park addition lands. This is because vehicle headlights can impede night sky viewing, and the interstate and railway detract from the undeveloped, natural scenery of the park addition lands.

Cumulative Effects

Present and reasonably foreseeable future actions in or adjacent to the national park addition lands include wind and solar energy development, potash exploration and mining, and gradual residential and commercial development. Such actions could have adverse effects on the visitor experience commensurate with the extent to which they are visible or audible from potential visitor use areas within the park addition lands. As shown in the Thickness of Potash Deposition map (chapter 3) and the Potential Visual Impacts of Wind and Solar Energy Development map (appendix C), these impacts could vary from long-term, moderate to major, and adverse—depending on the proximity of these mining and development activities to visitors.

The effect of the no-action alternative on the visitor experience, when combined with other present and reasonably foreseeable future actions, could result in negligible to major adverse cumulative impacts. The no-action's alternative's contribution to this cumulative effect would be slight.

Conclusion

The no-action alternative would result in negligible to minor adverse effects on visitor experience because of potential changes in land use. When combined with impacts of other present and reasonably foreseeable mining and development activities, the no-action alternative could have negligible to major, adverse, cumulative effects on the visitor experience. The no-action's alternative's contribution to this cumulative effect would be slight.

IMPACTS OF THE ACTION ALTERNATIVE

The action alternative could provide some modest new visitor opportunities. Examples include extended hiking and backcountry camping opportunities in designated areas of the addition lands, self-guided and guided on-site opportunities (e.g., interpretive tours), and expanded interpretive/education programs in the park's visitor centers. These opportunities could be provided once NPS staff has (a) identified addition lands areas that are suited to such uses, (b) acquired management responsibility for such areas, (c) resolved public access and safety issues, and (d) staffed up to manage such use. These modest new opportunities could provide some stimulus for additional visitation to the park, either by drawing new visitors or by encouraging repeat visits to enjoy different opportunities. The action alternative's effect on visitor use and experience would likely be long term, beneficial, and moderate.

As with the no-action alternative, the likeliest source of unnatural sound under the action alternative would be from vehicular traffic along Interstate 40 and train traffic along the Burlington Northern Santa Fe Railway — both of which bisect the park and addition lands. Under this alternative, these routes would be zoned Transportation Corridors, with limited opportunities for the National Park Service to reduce noise. Minor, localized, adverse impacts on natural soundscapes would continue from these activities. However, there would be no new adverse impacts under this alternative as a result of these ongoing activities.

As stated under the no-action alternative, these transportation routes would equally have minor adverse impacts on the night skies and viewshed of the park addition lands. This is because vehicle headlights can impede night sky viewing, and the interstate and railway detract from the undeveloped, natural scenery of the park addition lands. As stated earlier for soundscapes, there would be no new adverse impacts under this alternative as a result of these ongoing activities.

Conversely, the action alternative's partnership approach would emphasize collaborative relationships between the National Park Service and park neighbors to protect the viewsheds, night skies, and soundscapes of the

park addition lands — all of which are fundamental values of the park and important to the quality of the visitor experience. Actions that result from partnership agreements could be effective at avoiding or reducing adverse impacts, resulting in long-term, minor to moderate beneficial effects.

Cumulative Effects

The other present and reasonably foreseeable future actions described under the cumulative effects section of the no-action alternative would be the same for the action alternative — negligible to major adverse effects — depending on the proximity of mining and development activities to visitors.

The action alternative is likely to have beneficial, moderate, cumulative effects on visitor use and experience. However, because there would be no new adverse impacts from this alternative, it would not contribute to the adverse impacts of other non-NPS actions. Therefore, there would be no adverse cumulative impacts under this alternative.

Conclusion

The action alternative would result in minor to moderate beneficial effects on visitor use and experience. Other present and reasonably foreseeable future actions would result in negligible to major adverse effects. The action alternative would not contribute to these adverse effects.

IMPACTS ON PARK OPERATIONS

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

Implementation of a project or management plan can affect park operations — such as the number of employees needed, the type of duties that need to be conducted, how activities should be conducted, and administrative procedures. The methods for assessing impacts on park operations are based on how each alternative would affect such aspects of park operations, in the professional opinion of park staff, other NPS specialists, and the public. The thresholds used to assess potential changes in park operations are defined as follows:

Negligible: Park operations would not be affected, or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.

Minor: The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and successful.

Moderate: The effects would be readily apparent and would result in a substantial change in park operations that is noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

Major: The effects would be readily apparent and would result in a substantial change in park operations that is noticeable to staff and the public, and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

IMPACTS OF THE NO-ACTION ALTERNATIVE

Under the no-action alternative, NPS operational activities on the addition lands would remain largely limited to the small proportion of lands that are NPS-owned, and to a lesser extent, those that are state-owned. Operational activities would remain focused on baseline resource inventories, condition assessments, resource protection on NPS-owned lands (and to a lesser extent on state-owned lands), and on monitoring/managing NPS grazing leases. There would continue to be no operational investment devoted to managing visitor use or commercial visitor services on the addition lands. NPS administrative access to the addition lands would remain challenging because of the lack of access routes and the need to secure permission to enter privately owned lands. Under the no-action alternative, the park staff would do its best to manage the addition lands' operational load with current staffing levels. Considering all of the above, the no-action alternative's effect on park operations would continue to be minor and adverse.

Cumulative Effects

Potential future potash mining and residential and commercial development would require that park staff work cooperatively with private landowners, mineral rights holders, neighbors, and other entities to minimize potential effects on park resources and values. Impacts of the above actions, combined with the impacts of the no-action alternative, would result in long-term, minor, adverse cumulative effects on park operations. The no-action's alternative's contribution to this cumulative effect would be slight.

Conclusion

The no-action alternative's effect on park operations would continue to be minor and adverse. The cumulative effect on park operations would be long term, minor, and adverse. The no-action alternative's contribution to this effect would be slight.

IMPACTS OF THE ACTION ALTERNATIVE

Assuming that (a) private lands within the expanded park boundary are acquired from willing sellers by the National Park Service, and (b) the National Park Service acquires some management responsibilities for state lands within the park addition lands, NPS operational activities on the addition lands would be expanded to nearly 125,000 acres. Operational activities would remain focused primarily on resource inventories, condition assessments, resource protection, and NPS grazing leases. However, there would some new operational needs, such as managing visitor use in selected areas of the addition lands and providing expanded interpretive services. Administrative access to the addition lands should become less challenging, assuming private lands are eventually acquired. With expanded management responsibility for the addition lands, at least nine additional park staff would be required. Considering all of the above, the action alternative's effect on park operations would be long term, moderate, and beneficial and adverse.

Cumulative Effects

Potential future potash mining and residential and commercial development would require that park staff work cooperatively with private landowners, mineral rights holders, neighbors, and other entities to minimize potential effects on park resources and values. Impacts of the action alternative combined with the impacts of other actions, would result in long term, moderate, and adverse cumulative impacts; the action alternative's contribution to this cumulative effect would be substantial.

Conclusion

The action alternative's effect on park operations would be long term, moderate, and beneficial and adverse. The cumulative effect on park operations would be long term, moderate, and adverse; the action alternative's contribution to this effect would be substantial.

IMPACTS ON THE SOCIOECONOMIC ENVIRONMENT

METHODS AND ASSUMPTIONS FOR ANALYZING IMPACTS

The National Park Service applied logic, experience, professional expertise, and professional judgment in analyzing the effects on the socioeconomic conditions resulting from the no-action alternative and NPS action alternative. Available economic data, visitor use data, and park data were used to identify and evaluate likely effects. The regional economy for this impact topic is Apache and Navajo counties.

The three main factors considered in this analysis were

1. changes in staffing and federal spending
2. changes in visitor use levels and corresponding changes in consumer spending
3. private property tax revenue

Duration

The evaluation of effects includes a determination regarding duration. Duration has been categorized as either short term or long term to describe the amount of time the identified effect would likely occur. Short-term effects are temporary (would last for less than one year) and are typically transitional effects associated with implementing an action. Long-term effects on the socioeconomic environment may extend beyond one year and could be permanent.

Scale/Intensity

The scale or intensity of impacts refers to the change(s) associated with the action alternative when compared to current and future conditions under the no-action alternative. Factors considered in assessing the scale and intensity include the relative magnitude of changes, the likelihood of people being aware of the changes, the ability to measure the effects of the changes, and the number of people or size of the geographic area that would be affected. The scale/intensity thresholds for economic and social conditions are defined below.

Negligible — Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be barely detectable or detectable only through indirect means, and with no discernible impact on local social or economic conditions over the long-term.

Minor — Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be small but detectable, geographically localized, and affect few people, and effects would not be expected to substantively alter established social or economic structures over the long term.

Moderate — Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be readily apparent or observable across a wider geographic area, would affect many people, and could have noticeable effects on the established economic or social structure and conditions over the long term.

Major — Effects on adjacent landowners, businesses, community infrastructure, and social conditions would be readily detectable or observable, extend across much of the community or region, affect a large segment of the population, and have a substantial influence on the established social or economic conditions over the long term.

Type/Character

Beneficial — Effects that many individuals or groups would accept or recognize as

improving economic or social conditions, either in general or for a specific group of people, businesses, organizations, or institutions. Examples of beneficial effects include higher real personal income, lower unemployment, and increased social diversity and economic sustainability.

Adverse — Effects that many individuals or groups would accept or recognize as diminishing economic or social conditions, either in general or for a specific group of people, businesses, organizations, or institutions. Examples of adverse effects include reduced real personal income, higher unemployment, and an increase in the cost of living.

IMPACTS OF THE NO-ACTION ALTERNATIVE

Under the no-action alternative, there would continue to be a lack of public access and on-site opportunities for park visitors on the addition lands. The addition lands would continue to be identified on the Petrified Forest National Park brochure as "No access — private lands within authorized park boundary." Therefore, a visitor's ability to use and enjoy the addition lands would remain unchanged. Tax revenue would continue to be generated on the private lands in the addition (about 59% of the total lands in the addition).

Education and interpretation information would continue to be provided primarily in the pre-2004 national park, and no new facilities, development, or commercial services would be expected on the addition lands. Without the opportunity for park visitors to experience the addition lands, the no-action alternative would probably not stimulate a change in visitation. Therefore the local and regional economy would not benefit from increased visitor spending in the area. In addition, the National Park Service would not be expected to increase its annual operating costs or staffing from 2008 levels over the long term. The only increase in spending would be a one-time expenditure of just under $600,000 for a limited number of resource inventories for lands within NPS management jurisdiction as of December 2008 (assuming funding is available).

Although the no-action alternative is not expected to create local jobs or increase long-term NPS federal spending, a moderate one-time expenditure would have negligible, long-term, beneficial effects on the socioeconomic environment from spending on overnight accommodations and in restaurants and associated tax revenues.

Cumulative Effects

The area considered for evaluating cumulative impacts on the socioeconomic environment are Holbrook (the local economy) and Apache and Navajo counties (the regional economy). Reasonably foreseeable future actions in or adjacent to the national park addition lands include potash mining, gradual residential and commercial development, and other new projects in the region such as wind and solar energy development and the potential Navajo casino project. For example, the construction phase of the Dry Lake Project is expected to create construction and engineering jobs for 100 workers, and approximately five permanent operations and maintenance staff would remain after construction.

The economic viability of mining potash deposits and the possible construction of the casino would depend on future market conditions, including commodity prices and the overall health of the economy. If market conditions are favorable and profit margins outweigh potential risks, then potash mining and the construction and operation of the casino would provide new jobs, consumer spending (including multiplier effects) in the area, and sales tax revenue that would beneficially impact the local and regional economy.

Residential and commercial growth and development is expected to gradually increase within both Navajo and Apache counties

according to county population projections. Given the rural nature of the lands surrounding the addition lands, much of the population increase is likely to be absorbed by existing communities/ employment centers with established infrastructure. The rate of growth is expected to be slow, but could result in new construction- and real-estate-related jobs and new property tax revenue. This growth might be mitigated in the short term by the economic recession that began in 2008. If population growth does occur, the addition of taxable property and consumer spending would likely have a beneficial impact on the socioeconomic environment over the long term.

The addition of jobs, direct and indirect consumer spending, and tax revenue would benefit the local and regional economy.

Overall, the effects on the socioeconomic environment of the two counties from implementing the no-action alternative would be long term, minor to moderate, and beneficial.

Combining the likely effects of implementing the no-action alternative with the effects of other reasonably foreseeable future actions, there would be long-term, minor to moderate, and beneficial cumulative impacts on the socioeconomic environment. The no-action alternative would contribute a very small increment to this cumulative impact.

Conclusion

The no-action alternative would have negligible, long-term, beneficial effects on the socioeconomic environment as a result of modest one-time federal spending. When combined with the potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the no-action alternative would have long-term, minor to moderate, beneficial cumulative impacts on the socioeconomic environment.

IMPACTS OF THE ACTION ALTERNATIVE

The action alternative describes the management approach to be taken as the addition lands come into NPS management. Over time, the National Park Service would seek to provide modest new visitor opportunities on the addition lands, but such opportunities would only be made available if the risk of resource damage could be minimized. Increased visitor accessibility and opportunities would likely stimulate a minimal increase in park visitation and therefore increase both local spending in nearby communities and corresponding sales tax receipts. However, overall visitation levels would continue to be driven largely by unrelated economic conditions.

No new facilities are proposed in the action alternative, but a total one-time infusion of about $6 million is estimated for nonfacility costs, including resource inventories, condition assessments, resource mapping, and development of educational and interpretive programs and materials. A percentage of these nonfacility costs would be spent by people coming to the park/local area to do these inventories and assessments, which would temporarily benefit the local economy through additional spending and tax receipts from food and lodging. Also, to adequately monitor, inventory, and manage the addition lands, the action alternative would increase the park's annual operating budget, which would likely increase expenditures in the local and regional economy as a result of additional staff and expanded operations.

As addition lands come under NPS management, property tax receipts would decrease but would be offset somewhat by an increase in payments in lieu of taxes (PILT). PILT payments are made by the federal government to help mitigate the adverse effects of reduced tax revenue because of federal landownership.

Under the action alternative park visitation and corresponding visitor spending and sales tax receipts would be expected to increase,

park staff levels and operations would be expanded, and property tax receipts would likely be reduced. Therefore the action alternative would have a minor, long-term, beneficial impact on the local and regional economy.

Cumulative Effects

Overall, the effects on the socioeconomic environment of the two counties from implementing the action alternative would be the same as those described for the no-action alternative — long term, minor to moderate, and beneficial.

Combining the likely effects of implementing the action alternative with the effects of other reasonably foreseeable future actions, there would be long-term, minor to moderate, and beneficial cumulative impacts. The action alternative would contribute a small increment to this cumulative impact.

Conclusion

The action alternative would have minor, long-term, beneficial effects on the socioeconomic environment as a result of an increase in park jobs and spending as well as an increase in visitor spending. When combined with the potential impacts of potash mining, residential and commercial development, and other new sources of economic stimulus, the action alternative would have a long-term, minor to moderate, beneficial cumulative impact on the local and regional economy. The action alternative would contribute a small increment to this cumulative impact.

5

Consultation and Coordination

PUBLIC INVOLVEMENT, INCLUDING SCOPING

The public was notified of this planning effort via: (1) a *Federal Register* notice of intent, dated August 17, 2007, to prepare an environmental impact statement; (2) distribution of a scoping newsletter for the planning effort; and (3) a press release announcing a public comment opportunity, including public scoping meetings for the general management plan amendment.

> Scoping is an early and open process for determining the scope of a proposed action or project and for identifying issues related to the project. During scoping, NPS staff provide an overview of the project, including purpose and need and preliminary issues. The public is asked to submit comments, concerns, and suggestions relating to the project and preliminary issues.

Subsequently the National Park Service determined that an environmental assessment rather than an environmental impact statement is the appropriate level of environmental documentation for the plan amendment. On December 19, 2008, a *Federal Register* notice was published terminating the environmental impact statement in favor of an environmental assessment.

Newsletter 1, issued in February 2008,

- introduced the general management plan amendment planning effort
- outlined preliminary issues and frequently asked questions/answers about the planning effort
- presented the foundation for planning and management — the purpose and significance statements and the fundamental resources and values
- provided a general timetable for development of the general management plan amendment
- invited the public to participate in the planning process by providing comments
- provided a comment form and website link to facilitate public comment
- invited the public to attend scoping meetings for the general management plan amendment

A public comment period was open from February 8 to May 31, 2008. A public scoping meeting was held on March 3, 2008, in Holbrook, Arizona. The main purpose of the comment period and meeting was to introduce the planning process and gather ideas about what the plan should address. Frequently asked questions and answers were posted on the national park's website and were updated throughout the planning process. About 20 people attended the scoping meeting, and several people submitted comments at the meeting. The National Park Service received 14 comments submitted via the mail, e-mail, or web.

Newsletter 2, issued in July 2008,

- summarized public scoping comments
- provided a GMP amendment update
- presented alternative management concepts for the no-action and action alternatives
- invited the public to participate in the planning process by providing comments
- provided a comment website link to facilitate public comments

Three comments were received in response to *Newsletter 2*. The comments supported the information and management concepts presented in the newsletter.

The newsletters were distributed to the mailing list and were also made available at visitor centers and contact stations at the park. Newsletters and documents were also available online.

CONSULTATION AND COORDINATION TO DATE WITH OTHER AGENCIES, OFFICES, AND THE TRIBES

Consultation with federal and state agencies and American Indian tribes was initiated by the National Park Service in 2008 (see appendix D).

CONSULTATION WITH THE U.S. FISH AND WILDLIFE SERVICE AND THE ARIZONA GAME AND FISH DEPARTMENT

The National Park Service initiated informal consultation with the U.S. Fish and Wildlife Service (USFWS) on April 15, 2008, to determine if federal listed threatened, endangered, and candidate species might occur in the park addition lands. The Endangered Species Act of 1973, as amended, requires in section 7 (a) (2) that each federal agency, in consultation with the secretary of the interior, ensure that any action the agency authorizes, funds, or carries out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. This section of the act sets out the consultation process, which is further implemented by regulation (50 CFR 402).

The Arizona Ecological Services Field Office of the U.S. Fish and Wildlife Service responded to the request on July 16, 2008. Their letter referred the planning team to their website for species occurring in Navajo and Apache Counties, where the park addition lands are located.

In a letter dated April 24, 2008, the National Park Service also requested the Arizona Game and Fish Department (through the Arizona Natural Heritage Program) to provide input on state listed species that may inhabit the park addition lands. In a letter dated April 24, 2008, the department provided a list of special status species that may inhabit the area.

The information provided by the U.S. Fish and Wildlife Service and Arizona Game and Fish Department was used to develop the list of special status species found in "Chapter 3, Affected Environment."

The U.S. Fish and Wildlife Service and Arizona Game and Fish Department were also sent copies of the scoping and preliminary alternatives newsletters, and a copy of this draft document has been sent to them for their review.

NATIVE AMERICANS

The National Park Service recognizes that indigenous peoples have traditional and contemporary interests and ongoing rights in lands now under NPS management, as well as concerns and contributions to make for the future of lands recently added to Petrified Forest National Park. Related to tribal sovereignty, the need for government-to-government Native American consultations stems from the historic power of Congress to make treaties with Native American tribes as sovereign nations. Consultations with Native Americans are required by various federal laws, executive orders, regulations, and policies. For example, such consultations are needed to comply with Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments (11/2000), and Section 106 of the National Historic Preservation Act of 1966, as amended. Implementing regulations of the Council on Environmental Quality for the National Environmental Policy Act of 1969, as amended, also call for Native American consultations.

Formal consultation with tribes associated with Petrified Forest National Park was initiated in 2008. A formal request to consult was sent to the Hopi Tribe, the Navajo Nation, and the Pueblo of Zuni in April 2008.

Representatives from the tribes met with NPS staff in October 2008. The tribes' issues and concerns regarding the management of the park addition lands, such as the Native American Graves Protection and Repatriation Act and ethnographic resources, were discussed at the meetings.

Copies of this document will be sent to each associated tribe for review and comment. Tribes will have the opportunity to identify any subsequent issues or concerns, and the park will continue to consult during preparation of the GMP amendment and throughout its implementation.

Section 106 Consultation with the Arizona State Historic Preservation Office

Agencies that have direct or indirect jurisdiction over historic properties are required by Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 270, et seq.), to take into account the effect of any undertaking on properties listed in or eligible for listing in the National Register of Historic Places. Petrified Forest National Park superintendent Cliff Spencer communicated with James Garrison, the Arizona state historic preservation officer (SHPO), as follows. In a letter dated April 2008, to start meeting the requirements of 36 CFR 800, the superintendent informed Mr. Garrison about amending the national park's general management plan to include the addition lands. The letter invited him and his staff to participate in the planning process and comment on the draft plan as it progressed. The letter pointed out that SHPO comments and advice on the planning process and possible decisions regarding protection and preservation of the park's eligible historic properties that may be identified in the addition lands were welcome at any time. The state historic preservation officer responded with a letter indicating that they welcomed the opportunity to participate and would arrange a visit at a future date. A copy of this document was sent to the Arizona state historic preservation office for review and comment.

OTHER STATE AGENCIES

Arizona State Land Department

The National Park Service invited the Arizona State Land Department to participate in the planning process, and the two agencies are working together to develop a cooperative management agreement for the state lands within the addition lands.

In September 2007, staff from the Arizona State Lands Department participated with staff from the National Park Service in an orientation trip of the addition lands. Those in attendance from the state included the director of the land information, title, and transfer division; a land title specialist, and the state assistant attorney general, on behalf of Arizona State Lands Department.

In a letter from the Arizona State Lands Department, dated March 7, 2008, the department expressed strong support for the expansion of the Petrified Forest National Park. In an effort to facilitate the planning effort, the letter reaffirmed the department's willingness to continue working with the National Park Service to develop a legal instrument for this collaborative management approach.

LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS RECEIVING A COPY OF THIS DOCUMENT

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Natural Resources Conservation Service
  Springerville Service Center
  Holbrook Service Center

U.S. Department of the Interior
  U.S. Fish and Wildlife Service, Arizona
    Ecological Services Field Office
U.S. Environmental Protection Agency

U.S. SENATORS AND REPRESENTATIVES

Honorable John McCain, Senator
Honorable Jon Kyl, Senator
Honorable Ann Kirkpatrick, House of Representatives

STATE AGENCIES

Arizona Ecological Services Field Office
Arizona Game and Fish Department
  WMHB — Project Evaluation Program
Arizona State Parks
  State Historic Preservation Office

STATE OFFICIALS

Honorable Jan Brewer, Governor
State Senator Sylvia Allen
State Representative Jack A. Brown
State Representative Bill Konopnicki

AMERICAN INDIAN TRIBES TRADITIONALLY ASSOCIATED WITH PARKLANDS

Navajo Nation
  President Joe Shirley, Jr., Navajo Nation
  Office of the President and Vice President
  Tribal Historic Preservation Officer, Timothy Begay

Hopi Tribe
  Mary A. Felter, Tribal Secretary

Zuni Pueblo
  Governor Norman Cooeyate
  Kurt Dongoske, Director/Tribal Historic Preservation Officer, Zuni Heritage and Historic Preservation Office

LOCAL AND REGIONAL GOVERNMENT AGENCIES

James Jayne, County Manager, Navajo County Arizona
Delwin Wengert, County Manager, Apache County, Arizona
Carlo Pilgrim, City Manager, Holbrook, Arizona
Greg Martin, City Manager, St. Johns, Arizona
Jim Ferguson, City Manager, Winslow, Arizona
Ed Muder, City Manager, Show Low, Arizona
Paul Watson, Town Manager, Snowflake, Arizona
Eric Duthie, Town Manager, Taylor, Arizona
Kelly Udall, Town Manager, Pinetop-Lakeside, Arizona
Steve West, Town Manager, Springerville, Arizona
Bill Greenwood, Town Manager, Eagar, Arizona

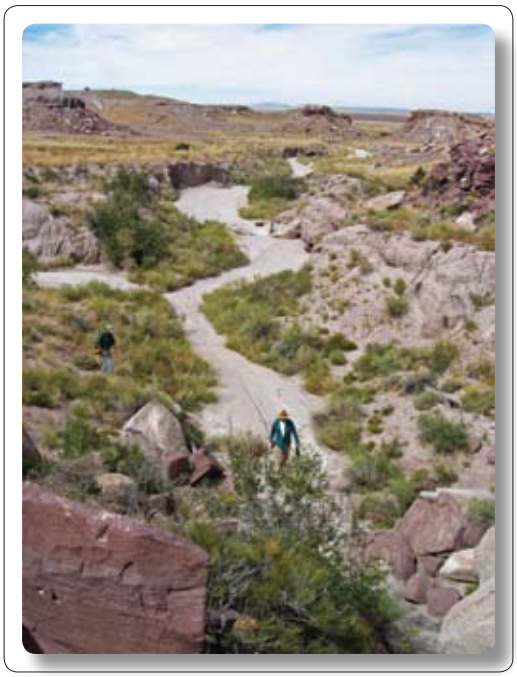
ORGANIZATIONS AND BUSINESSES

Xanterra Parks and Resorts, Inc.

INDIVIDUALS

The list of individuals is available from park headquarters.

Appendixes, References, and Preparers and Consultants



APPENDIX A: LEGISLATION

Note: For older legislation, please refer to the 2004 *General Management Plan Revision.*

Public Law 108–430
108th Congress

An Act

Dec. 3, 2004
[H.R. 1630]

To revise the boundary of the Petrified Forest National Park in the State of Arizona, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Petrified Forest National Park Expansion Act of 2004.
16 USC 119 note.

SECTION 1. SHORT TITLE.

This Act may be cited as the "Petrified Forest National Park Expansion Act of 2004".

16 USC 119 note.

SEC. 2. DEFINITIONS.

In this Act:

(1) MAP.—The term "map" means the map entitled "Proposed Boundary Adjustments, Petrified Forest National Park", numbered 110/80,044, and dated July 2004.

(2) PARK.—The term "Park" means the Petrified Forest National Park in the State.

(3) SECRETARY.—The term "Secretary" means the Secretary of the Interior.

(4) STATE.—The term "State" means the State of Arizona.

16 USC 119 note.

SEC. 3. BOUNDARY REVISION.

(a) IN GENERAL.—The Secretary is authorized to revise the boundary of the Park to include approximately 125,000 acres as depicted on the map.

(b) AVAILABILITY OF MAP.—The map shall be on file and available for public inspection in the appropriate offices of the National Park Service.

16 USC 119 note.

SEC. 4. ACQUISITION OF ADDITIONAL LAND.

(a) PRIVATE LAND.—The Secretary may acquire from a willing seller, by donation, purchase with donated or appropriated funds, or exchange, any private land or interests in private land within the revised boundary of the Park. In acquiring private land and interests in private land within the revised boundary of the Park, the Secretary shall undertake to acquire such private land and interests in private land first by donation or exchange.

(b) STATE LAND.—

(1) IN GENERAL.—The Secretary may, with the consent of the State and in accordance with Federal and State law, acquire from the State any State land or interests in State land within the revised boundary of the Park.

Deadline.

(2) PLAN.—Not later than 3 years after the date of the enactment of this Act, the Secretary shall, in coordination with the State, develop a plan for acquisition for State land or interests in State land under paragraph (1).

(3) MANAGEMENT AGREEMENT.—If the Secretary is unable to acquire the State land under paragraph (1) within the 3-year period required by paragraph (2), the Secretary may enter into an agreement that would allow the National Park Service to manage State land within the revised boundary of the Park.

SEC. 5. ADMINISTRATION. 16 USC 119 note.

(a) IN GENERAL.—Subject to applicable laws, all land and interests in land acquired under this Act shall be administered by the Secretary as part of the Park.

(b) TRANSFER OF JURISDICTION.—The Secretary shall transfer to the National Park Service administrative jurisdiction over any land under the jurisdiction of the Secretary that—

(1) is depicted on the map as being within the boundaries of the Park; and

(2) is not under the administrative jurisdiction of the National Park Service on the date of enactment of this Act.

(c) EXCHANGE AFTER ENACTMENT.—Upon completion of an exchange of land after the date of the enactment of this Act, the Secretary shall transfer administrative jurisdiction over the exchanged lands within the boundary of the Park as depicted on the map to the National Park Service.

(d) GRAZING.—

(1) IN GENERAL.—The Secretary shall permit the continuation of grazing on land transferred to the Secretary under this Act, subject to applicable laws, regulations, and Executive orders.

(2) TERMINATION OF LEASES OR PERMITS.—Nothing in this subsection prohibits the Secretary from accepting the voluntary termination of a grazing permit or grazing lease within the Park.

(e) AMENDMENT TO GENERAL MANAGEMENT PLAN.—Not later than 3 years after the date of the enactment of this Act, the Secretary shall amend the general management plan for the Park to address the use and management of any additional land acquired under this Act. Deadline.

16 USC 119 note. **SEC. 6. AUTHORIZATION OF APPROPRIATIONS.**

There are authorized to be appropriated such sums as are necessary to carry out this Act.

Approved December 3, 2004.

LEGISLATIVE HISTORY—H.R. 1630:

HOUSE REPORTS: No. 108–713 (Comm. on Resources).
CONGRESSIONAL RECORD, Vol. 150 (2004):
Oct. 4, considered and passed House.
Oct. 10, considered and passed Senate, amended.
Nov. 19, House concurred in Senate amendment.

APPENDIX B: MORE DETAILS ON USER CAPACITY

WHAT ARE INDICATORS AND STANDARDS?

An indicator is a measurable variable that can be used to track changes in resource and social conditions related to human activity. Existing conditions can then be compared to desired conditions. A standard is the minimum acceptable condition for an indicator. The indicators and standards help translate the broader qualitative descriptions of desired conditions in the management zones into measurable conditions. As a result, park managers can track changes in resource conditions and visitor experiences, and provide a basis for the park staff to determine whether desired conditions are being met. Monitoring the indicators and standards also helps NPS staff evaluate the effectiveness of management actions and provides a basis for informed management of visitor use.

POTENTIAL MANAGEMENT ACTIONS

User capacity also includes a range of potential actions that could be taken to maintain or restore desired conditions. For example, management actions may include providing information about low-impact recreational use and the principles of "Leave No Trace"; directing visitors to designated facilities or areas; adding or altering facilities (e.g., trails, campsites) to limit use to designated areas; directing visitors to lesser-used areas or off-peak times; restricting the types of recreation activities permitted; and/or reducing the amount of visitor use in certain areas.

THE PROCESS

User capacity decision-making is a continuous process; decisions are adjusted based on monitoring the indicators and standards. Management actions are taken to minimize impacts when needed. Once indicators and standards are identified, they should generally not change in the future. However, as monitoring of the park's conditions continues, managers may decide to modify, add, or remove indicators if better ways are found to measure important changes in resource and social conditions. Information on the NPS' monitoring efforts, related visitor use management actions, and any changes to the indicators and standards would be available to the public.

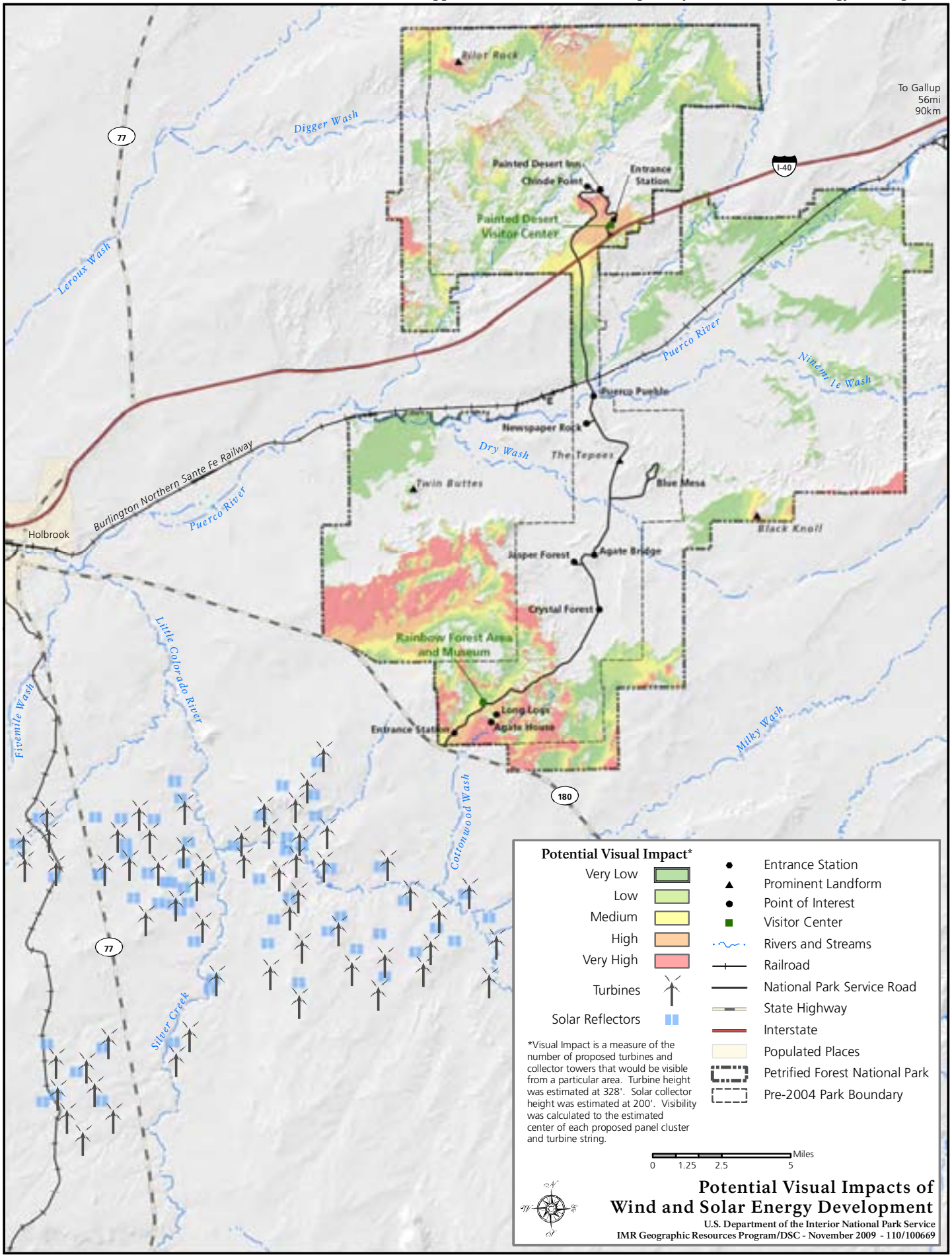
The information in the following table was developed after careful consideration of key aspects of desired resource conditions and visitor experiences, and more specifically the most likely use-related concerns for the addition lands. Of the many use-related issues that could be of concern for the addition lands in the future, the potential issues and related indicators described below were considered the most relevant given the importance and/or vulnerability of the resource and/or visitor experience being impacted.

TABLE B-1. POTENTIAL INDICATORS, STANDARDS, AND MANAGEMENT ACTIONS FOR ADDITION LANDS

Prioritized Potential Visitor Impacts of Concern	Potential Indicator Topics	Considerations for Monitoring and Potential Standards	Potential General Management Actions
Disturbance of Paleontological Resources: theft, displacement	• numbers of man-made holes (indicating resource theft) • fossils gathered into piles/removed from geologic context • theft/loss of fossils (proportion of species diversity, ratio of elements) • defacement/physical damage to fossil and/or matrix • incidences of graffiti or other depreciative behavior • level of visitor understanding regarding the sensitivity of the resource, and/or the practice of minimal impact recreation	Continue to collect baseline data on the location and condition of paleontological resources. Continue to assess the relationship between the degree of visitor access and type of visitor opportunities on the theft and displacement of paleontological resources.	• increased visitor education on regulations and Leave No Trace practices • increased enforcement of existing regulations, particularly in "hot spot" areas • changes in regulations (e.g., guided only access) • fencing or borders to discourage off-trail travel in sensitive areas • moving parking areas or trails further from sensitive resource areas • temporarily or permanently restrict access to specific areas • regulate the amount of use
Disturbance of Archeological Resources: theft, displacement	• number of incidents of disturbance, theft, or vandalism • number or percent of archeological resources removed • number of visitor-created trails near archeological resources • level of visitor understanding regarding the sensitivity of the resource, and/or the practice of minimal impact recreation	Continue to collect baseline data on the location and condition of archeological resources. Continue to assess the relationship between the degree of visitor access and type of visitor opportunities on the theft and displacement of archeological resources.	• increased visitor education on regulations and Leave No Trace practices • increased enforcement of existing regulations, particularly in "hot spot" areas • changes in regulations (e.g., guided only access) • fencing or borders to discourage off-trail travel in sensitive areas • moving parking areas or trails further from sensitive resource areas • temporarily or permanently restrict access to specific areas • regulate the amount of use

Prioritized Potential Visitor Impacts of Concern	Potential Indicator Topics	Considerations for Monitoring and Potential Standards	Potential General Management Actions
Vegetation and Soil Disturbance: vegetation trampling, soil compaction, erosion, litter	• total length of visitor-created trails • total area of disturbance due to visitor-created trails and/or campsites • number of visitor-created trails and/or campsites • density of visitor-created trails and/or campsites • amount of or increase in occurrences of litter and/or improperly disposed human waste	Continue to collect baseline data on the condition of vegetation and soil resources, including areas of human-caused disturbance. Evaluate conditions against preferred facility standards for trails and campsites.	• increased visitor education on regulations and Leave No Trace practices • increased enforcement of existing regulations • changes in regulations (e.g., no overnight use) • fencing or borders to discourage off-trail travel in sensitive areas • temporarily or permanently restrict access to specific areas • regulate the amount of use • redirect use patterns (e.g., direct use onto designated trails)
Crowding and/or Use Conflicts: complaints, noise, competition for sites, crowding, safety issues	• number/percent increase in visitor complaints • number of people at one time at attraction sites • ability to find parking • number of times the physical capacity of facilities are at or above capacity • number or increase in incidences of accidents, conflicts, or other safety issues that require law enforcement response • amount of litter and improperly disposed human waste • level of visitor understanding regarding regulations and Leave No Trace practices • excess human-caused noise (% of time audible)	Continue to document and evaluate trends in visitor complaints and law enforcement incidents. Periodically evaluate crowding and congestion events during peak use times. Conduct regular visitor surveys to evaluate and track trends in visitor characteristics, use trends, and visitor perceptions.	• increased visitor education on regulations and Leave No Trace practices • increased advanced planning information that encourages visitation to lesser used areas or at off-peak times, as well as information on important safety regulations • real-time information about parking availability; add more parking or redesign parking areas for greater efficiency; and close areas when full and actively redistribute use to other sites • increased enforcement • temporarily or permanently restrict access to specific areas • regulate the amount of use, possibly including limits on group sizes

APPENDIX C: POTENTIAL VISUAL IMPACTS OF WIND AND SOLAR ENERGY DEVELOPMENT


Potential Visual Impact*
Very Low
Low
Medium
High
Very High
Turbines
Solar Reflectors
*Visual Impact is a measure of the number of proposed turbines and collector towers that would be visible from a particular area. Turbine height was estimated at 328'. Solar collector height was estimated at 200'. Visibility was calculated to the estimated center of each proposed panel cluster and turbine string.
Entrance Station
Prominent Landform
Point of Interest
Visitor Center
Rivers and Streams
Railroad
National Park Service Road
State Highway
Interstate
Populated Places
Petrified Forest National Park
Pre-2004 Park Boundary
Miles
0 1.25 2.5 5
Potential Visual Impacts of Wind and Solar Energy Development
U.S. Department of the Interior National Park Service
IMR Geographic Resources Program/DSC - November 2009 - 110/100669
To Gallup 56mi 90km
Holbrook
Burlington Northern Sante Fe Railway
Digger Wash
Leroux Wash
Puerco River
Dry Wash
Ninemile Wash
Little Colorado River
Fivemile Wash
Cottonwood Wash
Milky Wash
Silver Creek
Painted Desert Inn
Chinde Point
Entrance Station
Painted Desert Visitor Center
Pilot Rock
Puerco Pueblo
Newspaper Rock
The Tepees
Blue Mesa
Twin Buttes
Black Knoll
Agate Bridge
Jasper Forest
Crystal Forest
Rainbow Forest Area and Museum
Long Logs
Agate House
Entrance Station
77
I-40
180

APPENDIX D: CONSULTATION LETTERS

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV

GOVERNOR
JANET NAPOLITANO
COMMISSIONERS
CHAIRMAN, WILLIAM H. MCLEAN, GOLD CANYON
BOB HERNBRODE, TUCSON
JENNIFER L. MARTIN, PHOENIX
ROBERT R. WOODHOUSE, ROLL
MICHAEL M. GOLIGHTLY, FLAGSTAFF
DIRECTOR
LARRY D. VOYLES
DEPUTY DIRECTOR
STEVE K. FERRELL

April 24, 2008

4/28/08

Cliff Spencer
Superintendent
United States Department of Interior
National Park Service
P.O. Box 2217
1 Park Road
Petrified Forest, Arizona 86028

Re: Petrified Forest Expansion

Dear Mr.Spencer:

The Arizona Game and Fish Department (Department) has reviewed your request dated April 15, 2008 regarding the above referenced project. A list of special status species within the project area is provided as an attachment. Be advised that I included a 3 mile buffer around your designated boundary, which is a standard we use in identifying the presence of T&E species in such a large area.

The Department appreciates the opportunity to provide comments. We would like to continue this coordinated effort and offer additional site-specific guidance that will help conserve wildlife and their habitats, including sensitive, threatened, non-game and game species. If you have any questions regarding this letter, please contact me at 623 236-7513.

Sincerely,

Daniel E. Nelson
Project Evaluation Specialist

AN EQUAL OPPORTUNITY REASONABLE ACCOMMODATIONS AGENCY

Petrified Forest Southwestern Section					
NAME	**COMMON NAME**	**USESA**	**USFS**	**BLM**	**STATE**
Catostomus sp. 3	Little Colorado Sucker	SC	S		WSC
Daihinibaenetes arizonensis	Arizona Giant Sand Treader Cricket	SC	S	S	
Pediocactus papyracanthus	Paper-spined Cactus	SC			SR
Astragalus xiphoides	Gladiator Milk Vetch	SC			SR
Lepidomeda vittata	Little Colorado Spinedace	LT	S		WSC
Aquila chrysaetos	Golden Eagle				
AZGFD HDMS check 4/23/2008					
3 mile buffer					

Petrified Forest extension: Northeastern Section					
NAME	**COMMON NAME**	**USESA**	**USFS**	**BLM**	**STATE**
Catostomus sp. 3	Little Colorado Sucker	SC	S		WSC
Daihinibaenetes arizonensis	Arizona Giant Sand Treader Cricket	SC	S	S	
Pediocactus papyracanthus	Paper-spined Cactus	SC			SR
Astragalus xiphoides	Gladiator Milk Vetch	SC			SR
Lepidomeda vittata	Little Colorado Spinedace	LT	S		WSC
Aquila chrysaetos	Golden Eagle				
AZGFD HDMS check 4/23/2008					
3 mile buffer					

Petrified forest: Northwestern Section					
NAME	**COMMON NAME**	**USESA**	**USFS**	**BLM**	**STATE**
Daihinibaenetes arizonensis	Arizona Giant Sand Treader Cricket	SC	S	S	
Astragalus xiphoides	Gladiator Milk Vetch	SC			SR
AZGFD HDMS Check 4/23/2008					
3 mile buffer					

Petrified Forest - Southeastern portion					
NAME	**COMMON NAME**	**USESA**	**USFS**	**BLM**	**STATE**
Astragalus xiphoides	Gladiator Milk Vetch	SC			SR
AZGFD HDMS Check 4/23/2008					
3 mile buffer					

ARIZONA STATE LAND DEPARTMENT

Janet Napolitano
Governor

Mark Winkleman
State Land
Commissioner

received
March 14, 2008

March 7, 2008

PFNP-GMP Team
National Park Service
Denver Service Center
P.O. Box 25287
Denver, CO 80225-0287

Attn: Miki Stuebe

Re: General Management Plan Amendment for Park Addition Lands; Petrified Forest National Park; Comments

Dear Ms. Stuebe and GMP Team Members,

The Arizona State Land Department appreciates the opportunity to comment regarding the Petrified Forest National Park's ("PFNP" or "Park") efforts to amend the Park's General Management Plan (GMP).

As the National Park Service is aware, the Arizona State Land Department strongly supported the 2004 Congressional action that expanded the boundary of the PFNP. Within the boundary expansion are approximately 35,000 acres of Arizona's Trust land, both surface and sub-surface estate. Those Trust lands share the same paleontological, archaeological, and natural resources that are unique to the current land within the Park. To facilitate the Park's planning efforts, the State Land Department is currently working with the National Park Service to develop a permit that would allow the Park access and limited management of the Trust lands within the Park's expanded boundary. This permit is intended as an interim measure until such time as the NPS acquires the State inholdings by purchase or other legal means.

The Department requests to be kept informed of the Park's planning progress and looks forward to the continued positive working relationship with the National Parks Service.

Should you have any questions, please do not hesitate to contact Mr. Richard Oxford, Director, LIT&T Division at 602-542-2501 or e-mail: roxford@land.az.gov.

Sincerely,

Jamie L. Hogue
Deputy State Land Commissioner

cc: R.B. Oxford, LIT&T
J. Hernbrode, Assistant A.G.
T. Arce, T&C

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General Comments

5/21

Arizona® State Parks

May 19, 2008

Cliff Spencer, Superintendent
National Park Service
Petrified Forest National Park
P.O. Box 2217
1 Park Road
Petrified Forest, AZ 86028

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602.542.4188

RE: General Management Plan Amendment/Environmental Impact Statement for Petrified Forest National Park Expansion Lands
SHPO-2008-0592 (36171)

Dear Mr. Spencer:

Thank you for consulting with our office pursuant to 36 CFR 800 about the amendment to the Park's General Management Plan to include expansion lands. We look forward to reviewing the draft revised Plan.

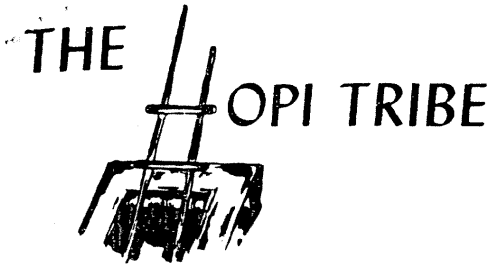
We would like to take advantage of your invitation for a site visit to some of the expansion lands and will coordinate with Patricia Thompson to arrange a visit some time this summer.

We appreciate your continued cooperation with our office in complying with the requirements of the Advisory Council's regulations at 36 CFR Park 800 and the National Programmatic Agreement.

Sincerely,

Jo Anne Medley
Compliance Specialist/Archaeologist
State Historic Preservation Office

Cc: Patricia Thompson, Chief of Natural and Cultural Resources, Petrified National Forest, AZ



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April 28, 2008

Cliff Spencer, Superintendent
National Park Service, Petrified Forest National Park
P.O. Box 2217, 1 Park Road
Petrified Forest, Arizona 86028

Dear Superintendent Spencer,

Thank you for your correspondence dated April 15, 2008, regarding Petrified Forest National Park beginning the process of planning for management of lands recently added to the park by amending the General Management Plan to define the overall management direction for lands located within the park's expansion boundary.

The Hopi Tribe claims ancestral and cultural affiliation to the so called Paleoindian, Archaic, Basketmaker, and Anasazi prehistoric cultural groups in this area, known to Hopi people as *Motisinom* and *Hisatsinom*, First People and People of Long Ago, and the Hopi Cultural Preservation Office supports the identification and avoidance of prehistoric archaeological sites and Traditional Cultural Properties. Therefore, we appreciate the Petrified Forest National Park's continuing solicitation of our input and your efforts to address our concerns.

The history of the Hopi clans that associates us with this area extends back over more than a thousand years. Therefore, cultural resources and how they can be protected from visitation and impacts from other resource uses is our primary issue of concern. Impacts on cultural resources from surface disturbance are long-term and permanent. Once an archaeological site has been impacted, the effect typically cannot be reversed. Avoidance of Hopi sacred sites and traditional use areas is the only real means of preventing impairment of these resources.

The key to avoiding impairment of Hopi resources under any of the proposed alternatives is successful and ongoing consultation with the Hopi Tribe. Therefore, we look forward to consultations on the development of alternatives for the General Management Plan Amendment/ Environmental Impact Statement for Petrified National Park Expansion Lands. If you have any questions or need additional information, please contact Terry Morgart at tmorgart@hopi.nsn.us. Thank you again for your consideration.

Respectfully,

Leigh Kuwanwisiwma, Director
Hopi Cultural Preservation Office

P.O. BOX 123 KYKOTSMOVI, AZ 86039 (928) 734-3000

United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

7/21/08

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JUL 18 2007
PETRIFIED FOREST
NATIONAL PARK

In Reply Refer to:
AESO/SE
22410-2008-SL-0403

July 16, 2008

Memorandum

To: Superintendent, National Park Service, Petrified Forest National Park, Petrified Forest, Arizona (Attn: Cliff Spencer)

From: Field Supervisor

Subject: General Management Plan Amendment/Environmental Impact Statement (EIS) for Petrified Forest National Park Expansion Lands

Thank you for your recent request for information on threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may occur in your project area. The Arizona Ecological Service Field Office has posted lists of the endangered, threatened, proposed, and candidate species occurring in each of Arizona's 15 counties on the Internet. Please refer to the following web page for species information in the county where your project occurs: **http://www.fws.gov/southwest/es/arizona**

If you do not have access to the Internet or have difficulty obtaining a list, please contact our office and we will mail or fax you a list as soon as possible.

After opening the web page, find County Species Lists on the main page. Then click on the county of interest. The arrows on the left will guide you through information on species that are listed, proposed, candidates, or have conservation agreements. Here you will find information on the species' status, a physical description, all counties where the species occurs, habitat, elevation, and some general comments. Additional information can be obtained by going back to the main page. On the left side of the screen, click on Document Library, then click on Documents by Species, then click on the name of the species of interest to obtain General Species Information, or other documents that may be available. Click on the cactus icon to view the desired document.

Please note that your project area may not necessarily include all or any of the species in a list. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Under the General Species Information, citations for the Federal Register (FR) are included for each listed and proposed species. The FR is available at most Federal depository libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted, or authorized activity, the action agency will need to request formal consultation with us. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency will need to enter into a section 7 conference. The county list may also contain candidate or conservation agreement species. Candidate species are those for which there is sufficient information to support a proposal for listing; conservation agreement species are those for which we have entered into an agreement to protect the species and its habitat. Although candidate and conservation agreement species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, we recommend the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

The State of Arizona and some of the Native American Tribes protect some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species, or contact the appropriate Native American Tribe to determine if sensitive species are protected by Tribal governments in your project area. We further recommend that you invite the Arizona Game and Fish Department and any Native American Tribes in or near your project area to participate in your informal or formal Section 7 Consultation process.

For additional communications regarding this project, please refer to consultation number 22410-2008-SL-0403. We appreciate your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Brenda Smith (928) 226-0614 (x101) for projects in Northern Arizona, Debra Bills (602) 242-0210 (x239) for projects in central Arizona and along the Lower Colorado River, and Sherry Barrett (520) 670-6150 (x223) for projects in southern Arizona.

Debra T. Bills

for Steven L. Spangle

cc: Josh Avey, Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ

:cgg

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Petrified Forest National Park

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